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Advertisement Index, see page xxxvi.

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Vol. LXXXV.] CONTENTS: December 19, 1919. [No. 2,195.

	Page
The Electricity Supply Bill	769
The Encouragement of Production	770
Scientific Management	771
Who are the Buyers?	771
Fuel Economy	771
Railway Rates	771
Self-Starting Unity-Power-Factor Synchronous Motors, by F. A. Lauper, A.M.I.E.E.	772
National Electricity Supply and Fuel Economy, by G. Wilkinson (*illus.*)	774
Class Distinctions in the Factory, by W. J. Hiscox	775
Training in Engineering	777
Import Trade of Ceylon	777
New Electrical Devices, Fittings and Plant (*illus.*)	778
Legal...	779
Correspondence	780
Business Notes	781
Notes...	787
City Notes	790
Stocks and Shares	791
Market Quotations	792
Magnetic Storms as Affecting Ocean Telegraph Cables, by E. Raymond-Barker (*illus.*)	793
The Institution of Electrical Engineers...	795
South African Electrical Undertakings	796
Scientific Management: A Solution of the Capital and Labour Problem, by J. M. Scott Maxwell	797
New Patents Applied for, 1919	800
Abstracts of Published Specifications	800
Contractors' Column ... ... Advertisement page	xxvi

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During the War, almost exceptionally among technical publications and periodicals of the character of the ELECTRICAL REVIEW, we have refrained from increasing the price. Owing, however, to the constant increases in cost of paper, printing, engraving and production charges generally, we have reluctantly decided that the price from the beginning of next year must be raised to 6d. per copy. The change will not apply to unexpired subscriptions.

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THE ELECTRICITY SUPPLY BILL.

IN view of the alteration to the Bill in the House of Lords, on Tuesday, and the sudden curtailment of the career of the District Boards, one is reminded of the old rhyme—

> If I was so soon to be done for,
> I wonder what I was begun for.

The District Boards have throughout the course of the Bill, from the very beginning, been the focus of discord. If the District Boards and the ancillary propositions had been left out of the Bill, or cut out at the beginning, the labours of Standing Committee B would have been cut down almost to a few days. The fact that the District Boards were the foundation of the scheme necessarily influenced everything else in the Bill, both as regards additions and omissions.

The important political significance of the alteration is that private enterprise, which had been hamstrung by the terms of compulsory purchase, is now restored to its original status. Both companies and municipalities are once more on something like level terms, and are merely invited, instead of being compelled, to enter into combination and reorganisation as "Joint Electricity Authorities." If they are unable or (more probably) unwilling to do so—well, they won't do it.

As we pointed out last week, it was open to them to do this while the District Board Clauses remained in the Bill, and the fact that failure to form a satisfactory Joint Electricity Authority involved the creation of a District Board with over-riding powers was a most powerful incentive to both parties to enter into such an arrangement. The District Board always loomed in the background as a sinister and incalculable factor. Now that the ghost is laid, we can only hope that both municipalities and companies will, for the credit of the industry, bestir themselves to put forward adequate schemes of co-operative reorganisation as quickly as possible, though past experience renders that hope somewhat forlorn, as Mr. Robertson's remarks in his recent I.E.E. address, for example, clearly indicate.

The companies are to be congratulated on having won a striking victory in the last ditch—a victory which surely transcends their most optimistic dreams, and which, we understand, was largely due to the efforts of Mr. H. B. Renwick, chairman of the Provincial Electric Supply Committee. That the "standard price" was grossly unjust to their shareholders was undeniable, and even their enemies will hardly mourn its disappearance from the Bill; it was adopted by the Standing Committee under circumstances which were, to say the least, unsatisfactory. On this score, those who voiced the companies' interests in the Committee Room have little ground for self-congratulation. If, however, electric supply undertakings do not wake up all round, and are not inspired to put forward some workable scheme, and the Government cannot get anything done without further *compulsory* legislation, the industry will deserve any fate it gets.

Writing while the Lords are sitting in Committee on the

Bill, we are not in a position to discuss its final form in detail, or to forecast with confidence its probable effect on the supply industry; but it seems certain that, shorn of their compulsory powers, the Board of Electricity Commissioners will be reduced to that "nerveless figure-head" so much desired by the reactionary party, a mere advisory board, so far as existing undertakings are concerned. In one respect only will the Commissioners have a free hand—namely, in the erection of super-stations where they are urgently required. They will also exercise the functions of the Board of Trade under the Electric Lighting Acts. The surprising evolution of the Government, which has been wittily described, according to the Parliamentary correspondent of *The Times*, as a *volte face*, was doubtless due to the impending close of the session, which left no time for parley; by thus surrendering features of the Bill which had been described by its representatives as indispensable, it has reduced the proceedings to a farce indeed.

As we go to press, we learn that the Government at present proposes to reintroduce, early next Session, those parts of the measure that have been thrown overboard. Whether it will carry out this intention remains to be seen. We have our doubts.

THE ENCOURAGEMENT OF PRODUCTION.

Every age has its catchword. Just as "efficiency" and "progress" in earlier days were set up as desirable ends for which to strive, so to-day "production" is regarded as the "open sesame" to the millennium. The evolution of a catchword has its origin in the desire to give, or to obtain, better service. We like to believe that everyone is anxious to give the best service of which he or she is capable, and constantly to improve upon the standard. It is also perfectly certain that everyone desires to be able to command the best service, and to have the standard constantly improved; and since service cannot be obtained unless service, or its equivalent, is rendered in return, there is an ever-present need and opportunity for progress and for increased efficiency.

Plenty is a necessary corollary of peace. The war being now a thing of the past, the scarcity which was bound to exist in war-time, ought to disappear. Hence the needs of the present age have to be expressed as a need for one thing—increased production. The necessity for a much greater supply of commodities of every kind, with the consequent cheapness and encouragement of demand which would follow, is obvious to most people, and the fallacy involved in the policy of restriction of output must, one would think, be at least equally obvious—not least so to those who advocate its practice.

It will generally be found, however, that when there are two sides to the question, a fallacy or wrong policy on one side is the complement, or counterpoise, of some corresponding wrong policy on the other side. Two wrongs do not make a right, but an attempt by one opponent to harm another usually brings the appropriate retaliation.

Applying this principle in the case of restriction of output, the corresponding error on the other side is not far to seek; it is the restriction of reward. This may be manifested by the cutting of the piece-rates of manual workers, by the imposition of a limit to the possible earnings of salesmen, by a flat-footed declaration that no man is worth more than n pounds a year, or in a number of other ways, all bringing about the same result. Until this attitude on the part of the employer is eradicated, and every attempt at a standardisation of remuneration at a definite level is abandoned, it will be useless to expect the worker, whatever his rank, status, or office, to accept the wages to which he knows he is justly entitled, while still placing complete reliance on the integrity of his employer. It is wrong, absurdly wrong, to decree that any particular class of worker shall be hovering continually around the poverty line, and frequently dropping below it; but this wrong is only one manifestation of the most serious error it is possible for mankind to commit. That error is, to attempt to obstruct the path of progress. All profess to desire progress, and if pressed to define their meaning, will probably give an answer to the effect that the whole world is progressing by reason of scientific discovery, the spread of Christian teaching and practice as to the relations between man and man, nation and nation, and that progress in this sense is eminently desirable. Quite so; no sane person would wish to dispute it. But the progress of the world is the progress of nations, and the progress of the nation means, if it means anything at all, the progress of the individuals composing the nation. And it means the progress of *all* those individuals—not some of them, not merely a chosen few, but all, from top to bottom. How fatuous, then, is the attempt to say to this or that group, this or that class of worker: "Thus far shalt thou go, and no farther!"

The joint control of industry is one of the most prominently discussed subjects of the day. The proper apportionment of the profits arising out of industry is closely associated with this problem of control. There is a considerable degree of concurrence of thought, except from extremists on either side, that the worker must share in the control and direction of, and the reward resulting from, industry. The main question of the moment, then, becomes: "How is this to be effected?"

The Higher Production Council has recently issued a pamphlet descriptive of a scheme which has been tried, apparently with considerable success, at the works of Messrs. Priestman Bros., Ltd. Briefly, the scheme endeavours to give every employé an interest in the increase of output. A standard is first determined, based upon the average of previous output over an agreed period. The method of calculating the output is also agreed—in the case under notice it is plain tonnage. The rate of remuneration of all the persons employed is presumed to be standard for the standard output. If the standard output increases by, say, 20 per cent., every individual employed receives for the next four (weekly) pay days an addition of 20 per cent. to his or her standard wages. The scheme is stated to have resulted in an average increased output of 50 per cent., with variations between 21 per cent. and 80 per cent. If the output falls below the standard, the deficit must be made up in the following month before the excess is arrived at.

This scheme seems to us to have much to recommend it. One particularly good feature about it is that the office staff is included. There has been in some quarters in this country a disposition to neglect the staff and to belittle their share in the result. It is, however, being driven home even to the more conservative minds that the proportion of staff employés to manual workers is smaller in this country than it is abroad, and the inference is inevitably to be drawn that the brainworkers of this country have borne more than an equitable share of the load. Their share in the reward has been disgracefully below what is right and reasonable, and for this reason we welcome heartily any scheme which has a tendency to redress this unjust state of affairs.

It is difficult to lay down a scheme for the whole of industry. The Industrial Parliament, whose future seems to have been so foolishly jeopardised on the very threshold of its existence, would have to devote much time and anxious thought to this question, before anything of the kind could be devised, and even the theoretically most perfect scheme would prove in practice to need a great deal of adaptation to any given set of circumstances. There is no difficulty at all, however, in the way of any individual firm trying out a similar plan to that described, in its own works—it would cost nothing to try it, and could not do any harm, while it might do much good.

The successful solution of the industrial problem will be best achieved by the conscientious effort of every individual to promote co-operative action, and to evolve a solution fitting the case nearest to him. The coalescing of a number of successful schemes, each working well in some direction or another, is a problem of an entirely different kind from the evolution of a cut-and-dried project intended to cover all the ground.

Scientific Management.

The paper on this subject which Captain J. M. Scott Maxwell read before the Institution of Electrical Engineers, last week, was not only timely and necessary, it was also ably conceived and handled with a breadth of view and human sympathy which do credit to the author, whose enthusiasm, moreover, shines forth on every page. So many and so gross misconceptions surround the subject in this country that a clear and well-informed account of its true significance and aims was urgently required, and we trust that Captain Maxwell's essay will receive the widest possible circulation amongst all classes, not only of the engineering industries, but also of the public in general; it carries a message to everyone, from the Prime Minister to the labourer, but, above all, to those engaged in every branch of industry. Mr. Atkinson stated that some had raised objection to the reading of the paper on the ground that it dealt with a "political" matter, and therefore was not suitable for discussion by the Institution; when will that "King Charles's head" be finally buried? There is no subject of more pressing interest to the members of the Institution and of the nation at large than that of increased production; the Institution lives on industry, and the keenness of the members to take part in the discussion amply justified the author's belief that it was an appropriate matter for debate. We are pleased to know that the paper has come before several other Centres of the Institution also.

We have in recent months devoted many pages to the questions dealt with by the author, regarding them as of the first importance to our readers in these days, when every endeavour should be made to extract the utmost output from human effort. We do not hold that the utmost effort should necessarily be extracted from human labour—far from it; that is a totally different thing, though many seem to be unaware of the fact. The point that we would emphasise, in agreement with the author, is that waste of all kinds should be eliminated—waste of effort in particular. As Captain Maxwell shows, and as numerous writers have shown before him, scientific management is directed to that end, and tends to reduce human effort whilst greatly increasing output.

The author advocates the adoption of scientific principles throughout the organisation of the State—a very desirable reform; but we fear it will be long before that aspiration will be realised. The dead hand of an obsolete system of training for State administration lies too heavily on the heart of the nation to permit of any speedy change of that nature. The traditions of Oxford and the public schools, which know not science, but worship the god of things that have been, oppose a formidable barrier to the path of scientific progress, and our governing classes are always a generation behind the times.

Who are the Buyers?

It would be interesting to learn who are the foreign purchasers of German machinery who are referred to in the annual report of the Berlin A.E.G. for 1918-19. As will be seen from the abstract of the report given in another column, the directors state that the demand for the company's products on the part of neutral countries, and of "hitherto hostile countries," shows that German industry "still enjoys its former esteem." It is comprehensible that so-called neutral countries are ready to accept machinery and plant dumped by Germany; it is also easy to understand France receiving Teutonic manufactures for a time, solely by way of partial reparation for German evil deeds in France, and for the purpose of expediting the work of industrial reconstruction; but is there anybody in his rational senses in Great Britain or Italy who would dream of knowingly buying from Germany any machinery or plant which can be produced in these two countries with native materials and native labour? If, however, there are any articles which we cannot turn out at home, our first duty is to approach Allied countries; failing these, we ought to apply to neutral countries, and only as a last resource should we take into consideration the question of importing machinery and plant from a country which has been sufficiently skilful to keep the drenching of blood outside its own territories, at least, in so far as the West of Europe is concerned. But, after all, is there really anything which the Germans can make which cannot be produced equally well, if not better, in Great Britain?

Fuel Economy.

Mr. George Wilkinson has for many years made a special study of methods of economising heat, and has put forward strong views on this subject on various occasions. Naturally, therefore, he is deeply interested in the proposals fathered by the Coal Conservation Sub-Committee, and supposedly embodied in the Electricity Supply Bill, with the object of conserving the nation's coal. He has a big target for his artillery—no less than the waste of 80 per cent. of the heat value of the coal used to generate electricity with the aid of steam, which must be admitted by all to be a deplorable proceeding—and elsewhere in this issue he commences an article in which he sets forth the methods by which he would utilise the heat of the coal to better advantage. Whether the internal-combustion engine is a possible alternative to the steam turbine, or no, it is undoubtedly desirable to leave no stone unturned in the search for higher efficiency, and to keep in the forefront the urgent necessity of promoting economy of fuel.

Railway Rates.

The daily Press gives particulars of important changes in the system of administration of British railways, which, "it is understood," the Government proposes to carry out. The country is to be divided into districts, and the independent management of the existing companies is to be replaced by district management. It is hoped to do away with duplication and overlapping, and to effect improvements in standardisation. There is undoubtedly ample scope for economy in these respects, but the process of changing the system will involve even greater difficulties than the reorganisation of electricity supply, owing to the fact that all the railways are interconnected and interdependent. However, if the managers bear in mind that the public benefit is the first consideration, and loyally work with that end in view, we may look forward to valuable reforms.

A less welcome announcement, but one which, under the circumstances, was inevitable, is that the rates for the transport of goods will be increased by an amount of 50 or 60 per cent. Obviously this will directly affect the cost of fuel for electricity supply, and the relative cost of electrical transmission and transport of coal. As Mr. Pearce pointed out in his paper before the I.M.E.A. in June, an increase in the cost of coal diminishes the advantage of transmission from a distant super-station, and reduces the distance of economical transmission.

An important feature of the railway situation is the agreement which Sir Eric Geddes has made with the Trade Unions, by which the latter are given a share of the determination of wages and conditions of service by representation on a Central Board and a National Wages Board, and agree that no strike shall take place on account of a dispute until one month after the matter has been referred to the latter Board. The Unions are also to be represented in the proportion of one in four on the Advisory Committee dealing with the control of the railways in general. The significance of these changes cannot be ignored; they are among the first fruits of the new order of things, and we trust that the happiest results will ensue from these beginnings.

SELF-STARTING UNITY-POWER-FACTOR SYNCHRONOUS MOTORS.

By F. A. LAUPER, A.M.I.E.E.

The grave disadvantages under which every electricity supply company has to run, when its load is of low power factor, is well known, and needs no further comment. Mr. E. W. Dorey's article on its improvement is, therefore, highly welcome, and points out a direction in which important economies for both supply undertakings and consumers may be affected.

The main reason of deplorably low power factors seems to be mostly due to the indiscriminate installation of induction motors, very often running much below their rated output with corresponding low power factors or chosen for such low speeds as to have the same effect. As is well known, synchronous condensers, static condensers, phase advancers, and vibrators are in all such cases most effective, but also very expensive remedies.

A better and less costly solution is, however, to tackle the trouble at its root. Only motors with the best inherent characteristics regarding power factor should be used. For larger sizes and slow speeds, synchronous motors, induction motors with secondary excitation from D.C. sources, or phase advancers would offer a much superior and more economical solution than odinary induction motors. Where variable speeds are required, A.C. commutator motors and their combinations will be employed to great advantage. Of all these machines the synchronous motor is the simplest and cheapest one, and in its modern design will find in the near future a field of application for most industrial drives, where until lately only the induction motor came into question.

Synchronous motors suffered in the past from the drawback that they were very troublesome to start and to synchronise with the supply or when self-starting, possessed only a very low starting torque. They were always known as the most efficient machines, of rugged construction, capable of handling heavy loads, and able to operate on unity or even leading power factor, but all these advantages were overshadowed by their poor starting qualities. Recent developments, however, have made the modern synchronous motor as easy, simple, and efficient in starting as an ordinary squirrel-cage induction motor, without impairing its favourable inh rent characteristics. Wherever they have been installed they have given splendid service, and effected important savings. Already several large American supply companies, which have recognised the importance of high-power-factor operation, have ruled that they will allow above 100 H.P. nothing but synchronous motors on ordinary loads, not requiring heavy and frequent starting. It is most probable that this type of motor will play an important rôle in the future industrial drive, and it will thus be of interest to analyse the different features of the synchronous motor more closely.

The synchronous motor is, in principle, an inverted alternator, usually of defined pole construction. If provided with solid poles, and the stator connected through an auto-transformer to the supply the machine will start up readily under light load, speed up, pull itself into step at synchronism, and run as a reaction machine. The necessary torque on starting is furnished by eddy currents induced in the pole faces. Very often, however, this type of machine runs only up to about half synchronous speed (especially when the field windings are short circuited), and is unable to accelerate further without assistance. With laminated poles the motor is just able to start up with twice full-load current.

When the pole faces are provided with a squirrel-cage winding the motor will start up like an ordinary induction motor, and as such run up to a speed corresponding to its rated slip. Unlike an induction motor, however, it will not remain running at this speed, but due to its defined pole construction will draw itself into synchronism and carry considerable load even without excitation while acting as a reaction machine.

If the rotor of the synchronous motor is of the cylindrical type, it cannot be brought into step with the line until it is excited. The defined pole construction, however, offering paths of varying reluctances to the alternating flux endeavours to put the field poles in a position of minimum reluctance with reference to the flux, thus pulling itself into step.

The starting of synchronous motors can most conveniently be studied by using the well-known circle-diagram. Its construction is the same as for the induction motor, but of course its proportions are different, due to the very big wattless component of the no-load current, and the low no-load power factor of these machines.

Besides having a good starting torque, synchronous motors must be able to run into step under considerable load, and thus require to have also a good pull-in torque. High starting torques, however, can only be attained at the expense of the pull-in torques by the ordinary squirrel-cage winding. It can easily be seen that the lower the slip speed at the pull-in point, the higher the required torque to pull the rotor into step. Thus high resistance damper-bars, although increasing the initial starting torque, reduce the pull-in torque through their slip, *i.e.*, lower speed at the pull-in point.

Nevertheless squirrel-cage windings of different materials offer a handy way to vary the starting characteristics very materially, by designing them for a definite slip, corresponding to the pull-in torque required. Such windings will then develop maximum torque on different slips for different resistance materials, and it is obvious that the maximum torque will exist at standstill for a certain critical squirrel-cage resistance.

The design of the distribution of the squirrel cage also affects the starting performance very much. If placed on a pole span of about 65 per cent., such as is used generally for alternators, both the starting and the pull-in torque will be moderate. Certain American firms use one or more floating bars between the poles, thus improving somewhat the poorly distributed squirrel-cage winding. A better solution now adopted by most manufacturers is to increase the pole embrace to about 75 per cent. of the pole pitch. This allows a much better distribution of the squirrel-cage winding, and reduces at the same time the equivalent air-gap, and with it the amount of necessary excitation. The extent of the pole span and its shape is, in the alternator, limited by the field leakage permissible when running at low lagging power factors, and by the required wave form. Synchronous motors for operation at unity and slightly leading power factors are not bound to the same extent to design their pole-faces principally to get a larger number and a much better placement of the slots for the damper.

In using an ordinary alternator as a synchronous motor by simply supplying its pole faces with a damper winding, good starting features can hardly be expected. Manufacturers using the same field pole design for both alternators and synchronous motors cannot take full advantage of all the opportunities offering better starting performances. The latest improvement in synchronous motor design is the use of double and triple squirrel-cage windings.

such as are used in the well-known "Boucherot" motors. Their function and construction are similar to those of compound squirrel cages. The first winding nearest the air-gaps is of high resistance and low reactance, the second winding, placed in slots below, is of medium resistance and reactance, and the last winding in the bottom slots is of low resistance, and since it is to be embedded deeper in the pole punchings, its reactance is high. According to the starting condition double or triple squirrel-cage windings will be employed, but generally the somewhat simpler double one is found to be sufficient for most cases.

At starting, the full line frequency acts on the squirrel-cage windings, and the high reactance winding will thus carry very little current. The top winding of low reactance but high resistance, however, will produce a high starting torque. As the motor runs up to speed, the frequency of the squirrel-cage currents will decrease and also reduce the reactances of the lower windings. Heavier currents will begin to flow in those windings, first in the middle one, and later in the lowest squirrel cage, consequently the torque due to those windings will increase up to nearly synchronous speed, whereas the torque from the high resistance winding will quickly fall off with increased speed.

Just below the pull-in point, practically all the torque is furnished by the low resistance squirrel cage, and the speed will correspond to the small slip of this winding. The difference between this speed and synchronous speed being small, approximately of the order of 3 to 4 per cent. the synchronising power will exert a good pull-in torque.

The torque curve of such multiple squirrel cages shows a pronounced dip of minimum torque, which lies at about 30 per cent. slip with double and at about 10 per cent. slip with triple squirrel cages, but it is usually possible to arrange the design to minimise this dip so as to make it of very little consequence for the successful starting of the machine.

The provision of properly designed multiple squirrel-cage windings on the pole span of synchronous motors will give very good starting features; such machines for heavy pull-in duty will start and pull into slips carrying a load amounting to 50 per cent. of full load with a K.V.A. input corresponding to about normal rating. Very likely in the near future improvements will enable us to build synchronous motors to start and pull in their full load with a K.V.A. input little exceeding normal full-load value.

From the above it can be seen that the starting problem of the synchronous motor has so far been solved as fully to justify its wider application in the industrial field.

It will be well, however, to point out at this stage that certain limitations to the use of synchronous motors cannot be overlooked. Services with extra heavy and numerous startings are unsuitable for synchronous motors. The same must be said of load requiring speed variations. Furthermore, synchronous motors of outputs smaller than, say, 100 H.P. are scarcely competitive with induction motors of good characteristics.

Severe starting duties can still be handled by synchronous motors, if we adopt the use of clutches, either of the mechanical or the magnetic type. The latter ones have recently been much perfected and have proved most satisfactory in actual service. They allow also the use of fly-wheel effect on heavy fluctuating load such as experienced with rolling mills, crushers, &c. The motor itself, due to its soft magnetic coupling, allows for a very short period the acting of the fly-wheel, but as the poles can only slide a little from their normal position without throwing the motor out of step, a clutch is always required to permit the fly-wheel to take its full share in carrying the load.

Synchronous motors working under full load will run at highest efficiency when operating at unity power factor. Although they do not supply any wattless currents to the line, they are correcting the power factor of the system while running at unity power factor. They can be made to supply a certain wattless current to the line, but for the same mechanical output their rating has to be correspondingly increased. The unity-power-factor synchronous motor is not suitable to run economically as a condenser with zero leading power factor.

Its field not being designed for this duty, will not carry the heavy field currents required for such operation, and the output of the machine would consequently have to be reduced.

The methods of starting modern synchronous motors is comparatively simple and requires at present no more experienced operators than induction motors do. Compensators or auto-transformers are used to reduce the supplied voltage, so as to keep the starting currents within reasonable limits. During starting the field circuit acts like the secondary of a transformer, and very high voltages are induced which may break down the insulation or be dangerous to the operator. This applies particularly to field coils having many turns, such as required for higher excitation voltages. To guard against this, the field system is usually during the starting period short circuited over a discharge resistance or broken up into sections and short circuited. Sometimes the field is left permanently connected across the armature of its exciter; if the latter is direct coupled or belted to the synchronous motor, the excitation will build up with the motor speeding up, and if of sufficient strength pull the rotor into step with the proper polarity. It is in all cases preferable to excite the field, while the motor is still on reduced voltage. This allows the rotor to slip back by one pole if of wrong polarity without causing too heavy a shock. The changing over from reduced to full voltage should be made as quickly as possible, otherwise the rotor will drop back too much and cause a severe shock to both the machine and the system.

An ammeter of the D'Arsonval type in the field circuit will be found very useful, as it shows very clearly when the motor pulls into synchronism.

Relays for changing automatically from reduced to full voltage have been used for some time with much advantage, and probably before very long complete automatic starting devices will be put on the market, which will demand no skill whatever to start a synchronous motor in the quickest and most efficient manner.

Once the motor is connected to the line little more attention is required. The machines are now usually designed not to require a rheostat for controlling the field excitation, and the exciter of present-day construction needs little looking after. The heavy squirrel cages necessary for starting purposes have, furthermore, abolished troubles due to hunting on load variations (a bugbear in the past for this kind of machine).

A few special points in favour of synchronous motors are their high overload capacity, high efficiency, and large air-gaps. The momentary overload of these motors with normal excitation is very great, usually several 100 per cent. of full load rating, and they are limited in this direction more by the heating of the motor than by anything else.

The efficiencies of synchronous motors surpass those of corresponding induction motors in nearly every case by several per cent., especially at lower speeds. For large outputs, for which these machines are most suitable, every single point of increased efficiency represents an important saving, which in the course of a year's operation will amount to many hundreds of pounds.

One of the weakest points of high-power-factor induction motors is their small air-gaps, which

through the wearing of bearings may lead to endless troubles if not constantly inspected and corrected. Synchronous motors possess three to five times larger air-gaps than induction motors, and troubles in this respect are practically unknown.

From what has been said above, there appears to be reason to believe that unity-power-factor synchronous motors should in the near future find a very wide application and supersede before long ordinary large induction motors almost completely. The great importance of maintaining high power factor has begun to be recognised also in this country, and power supply authorities may be expected to do their utmost, particularly at this time of high wages and coal prices, to effect all possible economies. The synchronous motor will be found to be a most desirable load for the supply company, helping to improve the existing power factor where induction motors would impair it still further, and acting at the same time as a most useful voltage regulator. From the user's point of view, motors of unity power factor will often enable him to obtain power at reduced rates, besides the direct saving due to their superior efficiencies.

In first cost synchronous motors above 100 H.P. output and below speeds of 500 R.P.M., will generally compare favourably with that of corresponding induction motors. However, these motors have been up to now regarded as more or less special machines by their manufacturers, and there seems every probability that with their introduction into the industry their prices could be reduced considerably, their construction being comparatively simple and their weights less than those of other machines.

NATIONAL ELECTRICITY SUPPLY AND FUEL ECONOMY.

By GEORGE WILKINSON, of Harrogate.

The report on "South Yorkshire Electric Power Supply," and the meagre details which have already appeared in the Press regarding the Nottinghamshire super-station scheme, put us into possession of the leading principles upon which the Government experts are setting out to achieve the desirable end of cheap and ample electric power for all.

The object is a worthy and urgent one, but the methods proposed for its achievement call into play serious misgivings in the minds of many engineers who have devoted their best days to the problems of electricity supply and kindred subjects.

At this critical juncture of our national life some of the questions which arise and clamour for a convincing answer in the affirmative, are as follows: Is the policy revealed in these epoch-making schemes one which can be justified in the light of present-day knowledge? Are the schemes on lines which will prove themselves sound at the end of, say, five years, when the immense capital involved is either already expended or irretrievably pledged? Are the methods such as can be commended having in view the necessity of conserving our great national asset, to wit, coal? Such questions—and they are important and far reaching—find no satisfactory answer so far as these huge Midland schemes are concerned.

Some problems involved in the economic distribution of so large an amount of electrical energy from one or two centres over so wide an area of country are as yet unsolved, and the apprehension of numbers of well-known electrical engineers on this head alone should give pause before actual commitments are entered into. It is possible that the necessary capital expenditure for distribution alone will serve to nullify all the alleged economic advantages of super-station practice. On this aspect of the case the writer offers no criticism except to suggest that it is serious enough to call for close investigation by a board consisting of well-known and independent engineers who have already actually designed, laid down, and operated electrical networks of considerable extent.

It is assumed that plant will be erected to extract the valuable by-products from the coal prior to its combustion, after which the resultant gas, coke, and possibly heavy oils will be used for steam production in the best type of boiler plant; also that large and economical turbo-generators are to be used for the electric generation.

While these refinements will result in a better economy in the super-station than is obtained in many present-day works of smaller size, the whole position calls to mind the case of the man who laboured diligently to stop the small leak at the spigot, while he lost sight of the huge leakage at the bunghole.

In the case of the Nottinghamshire super-station it is stated in the public Press that when full equipment is reached, at an estimated cost of over £14,000,000, the works will consume 1,500 tons of coal a day, and will require no less than 14,000,000 gallons of cold water per hour for condensation purposes.

Divested of technical details, and stated in simple language, it amounts to this: The super-stations on the lines projected will be so prodigal of heat energy that they must perforce be situated either on the sea-board or on the banks of our mightiest rivers, where alone a heat-absorbing medium can be found in sufficient volume to destroy the immense amount of heat which must be thrown away.

Having these facts in mind, it is difficult to maintain a claim either to cheap electricity supply or to a wise use of our precious coal resources.

Put in another way, and employing round figures which are near enough to emphasise the crucial point under discussion, it may be stated that for every 5,000 tons of coal, or its equivalent, consumed 1,000 tons will be lost in producing steam in the boiler plant, 3,000 tons, or 60 per cent. of the total, will be thrown into the water, and 1,000 tons only will appear in the shape of useful electrical energy.

In this connection it should be prominently borne in mind that our houses, factories, public buildings, wash-houses, laundries, and the like, are in need of this heat; in such places it can be most usefully employed. If so employed it will save large amounts of fuel at present consumed in our buildings under most extravagant conditions, it will secure a cleaner and more healthful atmosphere in areas where the population is dense, greatly decrease labour, especially in the domestic domain, and last, but not least, provide a substantial revenue as a by-product of electricity supply. In the course of time when national electric supply concerns develop throughout the country it would allow either substantially more coal for export to the towns of our needy Allies, or serve to husband the coal resources at home.

Much more might be written on this topic, but enough has been stated to justify the plea that the present projects for national electricity supply should be amended in favour of methods more economical of coal, and capable of meeting other pressing public needs in addition to cheap electric supply.

Following on this destructive criticism, it is necessary to look for proposals for supplying cheap electrical energy with a more rational use of the national fuel resources. Obviously the 20 per cent. loss in

the boiler house, and the 60 per cent. loss in the cooling water, are the items to be dealt with, if true and not relative fuel economy is to be realised.

The first loss may be met by disposing of the boiler house, and the second, which, when once realised in its bearing on national prosperity, is of staggering dimensions, by dispensing with the condensers. Both these desirable ends can be met by substituting some form of internal-combustion prime mover in place of the steam turbine. This somewhat startling and drastic proposal will be met immediately by the objection probably emphatically expressed, that there are no such prime movers in existence powerful enough for the work involved. On this point more later, but, in the meantime, it is useful to consider what the possibilities of such plant are, taking the figures and data furnished by plant in the sizes already in operation. In the case of both oil and gas engines of good design, working under proper conditions, it is found that a useful efficiency of over 30 per cent. can easily be obtained;

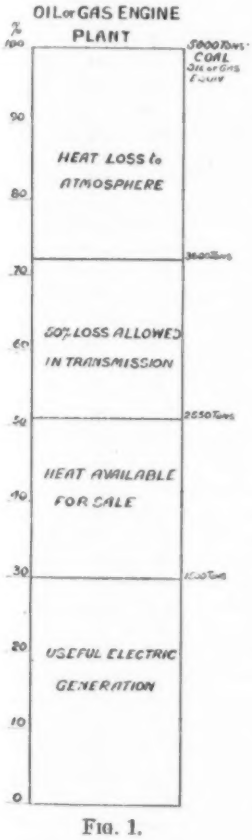


Fig. 1.

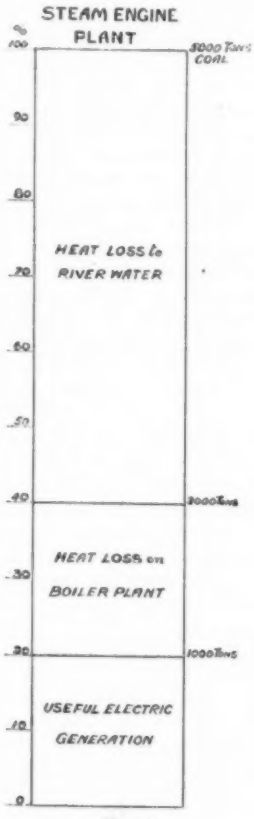


Fig. 2.

thus for generating sets of equal output an increased efficiency round about 10 per cent. may be realised, as compared with steam-driven sets for the amount of fuel consumed.

Independent published tests show that such prime movers dissipate about 30 per cent. of the heat of the fuel through their cylinder jackets into the cooling water, and 35 per cent. to 40 per cent. in the spent gases exhausted to atmosphere. This represents in round figures two-thirds of the total heat of the fuel consumed. Fortunately, however, it is dispensed by the engine in such a way that at least 60 per cent. of this heat can be recovered and usefully employed for industrial, public, and domestic purposes in substitution for the large quantities of coal at present used for precisely the same work.

The relative useful work obtainable by electric power houses equipped with internal-combustion engines and steam plant with condensers is approximately set out in diagrammatic form in figs. 1 and 2. In fig. 1 60 per cent. only of the heat discharged to the water jackets and in the exhaust gases is represented, and a loss in heat transmission of 50 per cent. is allowed. Comparing the two diagrams they show for every 5,000 tons of fuel consumed the useful employment of 2,550 tons of fuel in the case of internal-combustion plant with heat distribution, as against 1,000 tons in the case of steam turbine plant.

(To be concluded.)

CLASS DISTINCTIONS IN THE FACTORY.

By WILLIAM J. HISCOX.

The industrial troubles of the last few months have let loose a lot of wild talk about "Capital and Labour," "Employer and Employé," "The Worker and the Management," and so on, the inference being that in each group the one factor is antagonistic to the other. It is the extremists on both sides who, with deliberate intent, are insisting that the gulf which divides the classes cannot be bridged, and who, by their speeches and writings, are endeavouring to draw to their respective banners, not merely the discontented, but also the great mass of fair-minded, level-headed people belonging to the class the extremist presumes to represent.

It may be that the tactics employed meet with a certain amount of success, though it is in many cases disgust at the methods employed by the extremists of one class which drives the fair-minded man of the other class into the arms of his own extremist. Thus, many an employer has joined forces with other employers whose methods are repugnant to him, simply because of the intolerable demands of his men, whilst, on the other hand, men have been forced to enrol under the banner of the extremist on account of the tyrannical and high-handed methods of the employer.

The catchwords quoted above have therefore some significance to the industrial population of this country, and in the engineering section, in particular, feeling is very acute. Yet it is in this section, probably more than any other, that, with a little reasoning, these phrases could be rendered almost meaningless, for the classes are so intermingled that it is almost impossible to differentiate. It will be observed that the word "almost" is used, for it is not intended to convey that under our present system of society it is possible, even in an engineering factory, to establish Utopia. Personal interest is still the first consideration of all of us, and until this is toned down with a measure of appreciative regard for our fellows, class distinction must exist in some shape or form.

In everyday life society is divided into classes—the aristocracy, the middle classes (sub-divided into the upper and lower), and the working classes. These are fairly distinct, except that that portion of the working classes whose labour is remunerated with a salary is regarded as belonging to the middle classes, leaving the working classes to be represented by wage earners.

In the engineering factory the class distinctions are no less marked. We have the aristocracy (the directors), the middle classes, this time sub-divided into three (the high management, the subordinate officials, and the administrative staff), and the working classes. Class in the factory is determined by position, and not by the amount of remuneration for services rendered, for under present conditions many of the workers receive more than their foremen (although the latter are placed in the higher category), whilst in the main the remuneration extended to the administrative staff is quite eclipsed by that which falls to the lot of the average worker.

Whatever may be said regarding the merits or demerits of any specific industrial dispute, it cannot be gainsaid that snobbery has a most important bearing on the case, and the reason why, in many cases, a dispute cannot be settled amicably, without resorting to extreme measures, is due to disinclination on the part of the disputants to take each other seriously, on account of (workshop) reputed social inferiority or superiority. Snobbery is the nation's besetting vice, and it is as prevalent amongst the working classes as amongst the other classes of society.

It may be said that the positions created to ensure an efficient factory organisation must be maintained, but they can better be maintained by dignity than by snobbery. There is a world of difference between the two, and the relative effects are most marked. The position maintained by dignity is strengthened by self-respect, which is only possible when the respect of one's fellows is gained. One does not need to see eye to eye with the other in order that respect may be engendered, and although for the moment the policies of the two are antagonistic, it may be that mutual respect will bring the matter to a common ground, and a satisfactory settlement will be effected.

And the snob? No matter what position he occupies, he cannot command respect. He may have his satellites, creatures cast in the same mould as himself, who fawn upon him and flatter him. But respect? How can he have respect for them or they for him, and how can he gain the respect of the honest man? He is mistrustful, and he is distrusted. If those under him endeavour to make a move in the right direction he is suspicious. If he is fired with the ambition to do a straight turn he is suspected. Small wonder, therefore, that industrial unrest is prevalent, with such a state of affairs existing in the factory.

This may be termed snobbery in high places, as it affects people on the lower plane; but it also exists between people of ostensibly the same class. The foreman who is a snob to his men is a snob to his fellows, fawning upon the powerful and expressing contempt for the weak. A room must be set apart in the works canteen for the foremen, and a separate table in the separate room for the foremen of high degree. It is on record that in one large establishment the only two heads of departments who visited the canteen for a certain meal each day sat at different tables, owing to social distinction.

The chasm between the manual worker and the clerk is too well known to need demonstration, and we may therefore pass to the class distinctions amongst the workers (*i.e.*, the wage earners). It would be thought that here, at any rate, snobbery would not find a place, but as at the top, so at the bottom. We had a fine example of it during the war, when the "skilled" men blew their trumpets, and told the world they were not as other men. And the feeling is there to-day. What qualified turner is prepared to accept the qualified miller or driller as an equal, or what machine hand in any capacity is prepared to place the shop labourer on his own level? And yet, in many cases, it was only by an accident that the positions were not reversed. One had the opportunity, and the other did not, and yet the labourer may be a far better man at his work than the mechanic is at his.

So much for this; and now the question arises, "What does it all imply?" Again taking the engineering shop as the basis of the argument, it is evident by the foregoing that class (or grade) distinction amongst the workers is to a very great extent the cause of the snobbery which is made manifest higher up the scale, seeing that the factory officials are recruited from the ranks of the workers. It is important, therefore, that the elimination of class distinction starts at the bottom, and when this has been accomplished amongst the workers the evil will have received a mortal blow. At the moment it is being fed at the bottom, but when this source of supply fails, the top must speedily wither. The officials of to-morrow will be recruited from the rank and file of to-day, and if from the latter snobbery and class distinction are eliminated, the probability of the evil cropping up in the higher sphere may be considered very remote.

A man may rise above his fellows, on account of his natural abilities, but this does not give him the right to despise those less gifted than himself. So it is that when he is promoted to the position of foreman, he must remember that he is still a worker (in the best sense of the word), and that his fellows of yesterday are the same fellows to-day, who rejoice in his success, and who add to their regard the respect due to the position he now adorns. A feeling in the workshop such as this would clear away all misunderstandings, disarm suspicion, and establish an atmosphere of kindly toleration, thus making it possible for differences to be discussed and adjusted without the bitterness and animosity now, alas, too often displayed.

We talk loosely of the employer and employé, implying that they constitute two separate and distinct classes, but in the modern engineering factory again the fallacy is exposed. The works manager, regarded by the workers as the employer, is in reality a paid servant of the company—an employé. The foremen, who possess the power to engage or to discharge a man, without reference to the higher authorities, are employers, just as much as the works manager. Yet they are at the same time employés, and, further, they are from the ranks of the workers themselves. A fitter to-day, entitled to no special consideration in respect of his continued employment, is at the mercy of his foreman. To-morrow *he* is a foreman, possessing power which transforms him into an employer, and yet, at the same time, as a paid servant of the company—an employé—he is not immune from dismissal, at the hands of a higher authority, who is also an employé.

When once this is thoroughly assimilated, it will be seen how ridiculous these catch-phrases are, and the management and the workers' cry is another case in point. What constitutes the management in the up-to-date electrical engineering factory? The works manager? He is but a unit. And his assistants? But who are they, and when is the limit reached? The manager, the technical staff, the commercial staff, the administrative staff, the shop foremen, under foremen, and charge hands! But why stop there? Would it not be fairer to say that the works management is not complete unless it embraces the whole of the "workers," whether manual or otherwise?

"Capital and Labour"! Is it not the ambition of every worker to save a little and invest it? He earns the money in the first place, but does he earn the dividend that accrues from his investment? Whether he invests in the Post Office, insurance company, building society, or in an engineering concern the same principle applies. He is a capitalist, and he cannot get away from the fact. Trade unions do not hoard their members' contributions in long stockings. They invest them, and, in spite of their hostility to the capitalist, they have no compunction in drawing the dividends, thus transforming every member upon the books into a capitalist. Has it not been reported that the railway men's union has money invested in railway stock, and is it not illogical, therefore, to speak of Capital and Labour as antagonistic?

Many thousands of workers have their shilling or half a crown "on a horse," as a speculation, and if they "spot a winner," their winnings are regarded as a remuneration for the risk incurred. Many thousands more gamble with the insurance companies. If they die before the appointed time, they

win; if they don't, they lose. So it is with any man who invests money in a business, and he receives a dividend proportionate to the risk incurred.

It is not the writer's intention to champion any one class, but merely to point out how intermingled the so-called classes are, in the engineering industry, at all events. Doubtless in the past the gulf divided the employer and employé, and in many small concerns to-day, where the principal actively conducts his business, the old definition of "master and man" still holds good. The whole trend of modern factory organisation, however, aims at the elimination of this definition, and it is certain that with commonsense reasoning, industrial unrest can to a very great extent be obviated. The writer, as the head of a department, is an employer, and also a member of the management. As such, he has certain responsibilities, and also privileges. These, however, do not blind him to the fact that (in spite of his position) he is a paid servant of the company—a worker.

TRAINING IN ENGINEERING.

The Ministry of Labour thinks it desirable to make the following announcement in order to explain to candidates for training and to the public the reasons why there has been difficulty in giving training under the training-grant scheme in the engineering trades, and to remove any misunderstandings which may exist in the minds of members of the trade unions concerned.

This training-grant scheme was devised in the interests of resettlement to restore the supply of men of higher professional, business, and technical attainments, by selecting for training at State expense ex-service men whose preparation for civil careers has been prejudiced by their war service, and whose family circumstances do not permit of their undertaking training at their own expense. The scheme covers practically all professional, commercial, and business occupations. In the interests of the nation and of the individuals concerned, it is considered that ex-service men should not be debarred from entry into any trade or profession, and it is not apparent that there is any adequate reason why an exception to this general rule should be made in the case of the engineering trades.

Practically every industry and calling has shown its willingness to take its share of ex-service men for training, and in almost every case special concessions as regards their entry into the trade or profession have been made.

The engineering training given under the scheme is in no way intended to qualify men to compete with journeymen in the trade, but its object is to qualify them mainly for the commercial or office side.

The engineering trade unions objected to the introduction of the scheme on three principal grounds.

1. That the trainees under the appointments department scheme would fill the better positions in the industry to which the ordinary industrial apprentices would aspire.

2. That many industrial apprentices were still with the Colours, and many trade unionists were out of work.

3. That the scheme would "militarise" the factories.

To meet these objections certain modifications of the original scheme were proposed by the Ministry, and these have for some time been under consideration by the trade unions.

As regards the number of trainees, it is suggested that this should not exceed 1,750, which is less than one-third per cent. of the total membership of the engineering trade unions. As a further safeguard the number of trainees in any one factory would not exceed one per cent. of the total number of employés in the works.

Most of the engineering trade apprentices are now demobilised, and to ensure that the trade should not be overcrowded with trainees from other industries, it is proposed that except in the cases of the disabled, the only candidates who will be considered for grants are those who, previous to their war service, had not entered upon civil careers in any trade or profession other than engineering.

The machinery through which candidates are selected for training under the scheme consists of interviewing boards sitting in all the principal towns of the United Kingdom. In order to ensure that no trade union principles are infringed it is proposed that the engineering trade unions should nominate representatives to sit on these boards.

It is pointed out that more than 50 per cent. of the ex-service men who have up to date obtained grants are men whose war service was in the ranks, and that a considerable proportion of the officers who are accepted for training are men who have risen from the ranks. Moreover, in a large proportion of cases, the parents of the applicants belong to the working classes, and their sons, without State assistance for training, might be compelled to drift into the unskilled labour market. The grants are intended not for the sons of rich fathers, but to assist men whose parents are in poor circumstances, and it is one of the duties of the interviewing boards to pay special attention to this point.

It is thought that the misconceptions which have existed in the past can be removed if it is made clear to the members of the trade unions concerned that men in needy circumstances, and in some cases their own sons, may be selected to enjoy the benefits of this scheme, and so may qualify for positions which without this assistance would have been out of their reach.

IMPORT TRADE OF CEYLON.

The following figures, showing the value of the imports of electrical and allied material into Ceylon during 1918, are extracted from the recently-issued official statistics. For purposes of comparison with the last normal year of trade, the values for 1913 are given and notes of any increases or decreases added.

	1913. Rupees.	1918. Rupees.	Inc. or dec. Rupees.
Manufactures of Copper.—			
From U.K.	45,000	4,000	– 41,000
,, India	33,000	5,000	– 28,000
,, Other countries ...	51,000	93,000*	+ 42,000
Total ...	129,000	102,000	– 27,000
* Japan 82,000. U.S.A. 11,000.			
Electrical materials.—			
From U.K.	209,000	44,000	– 165,000
,, India	2,000	4,000	+ 2,000
,, Germany	15,000	—	– 15,000
,, U.S.A.	8,000	9,000	+ 1,000
,, Other countries ...	4,000	54,000*	+ 50,000
Total ...	238,000	111,000	– 127,000
* Japan 50,000.			
Scientific instruments.—			
From U.K.	31,000	6,000	– 25,000
,, India	1,000	7,000	+ 6,000
,, U.S.A.	—	2,000	+ 2,000
Total ...	32,000	15,000	– 17,000
Lamps.—			
From U.K.	140,000	37,000	– 103,000
,, Japan	8,000	12,000	+ 4,000
,, Germany	105,000	—	– 105,000
,, Other countries ...	31,000	21,000*	– 10,000
Total ...	284,000	70,000	– 214,000
* U.S.A. 16,000.			
Machinery, foundry and workshop.—			
From U.K.	1,075,000	165,000	– 910,000
,, U.S.A.	15,000	2,000	– 13,000
,, Other countries ...	5,000	19,000*	+ 14,000
Total ...	1,095,000	186,000	– 909,000
* Japan 11,000.			
Other machinery, dutiable, not including tea, textile and oil making.—			
From U.K.	53,000	32,000	– 21,000
,, Other countries ...	5,000	14,000*	+ 9,000
Total ...	58,000	46,000	– 12,000
* Japan 7,000.			
Ditto, free.—			
From U.K.	1,407,000	261,000	– 1,146,000
,, Germany	145,000	—	– 145,000
,, U.S.A.	78,000	76,000	– 2,000
,, Other countries ...	105,000	53,000*	– 52,000
Total ...	1,735,000	390,000	– 1,345,000
* Japan 27,000. British India 16,000.			
Telephone materials.—			
From U.K.	433,000	3,000	– 430,000
,, Other countries ...	—	4,000*	+ 4,000
Total ...	433,000	7,000	– 426,000
* Sweden 3,000. U.S.A. 1,000.			

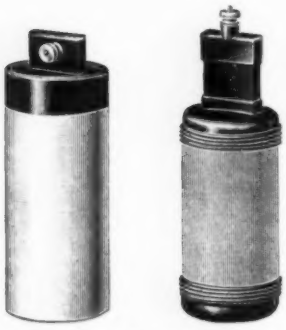
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

E.S. Dry Cells.

The Associated Dry Battery Co., Ltd., of Southey Street, Penge, S.E., have introduced a number of improvements in their well-known "E.S." dry cells, which they have been manufacturing for 27 years.

One difficulty in respect of the use of dry cells in tropical countries lies in the fact that the extreme humidity of the air at certain seasons makes any casing of cardboard rapidly assume the character of a conductor, causing short circuit when the cells are stood together. To obviate this, the company is now supplying cells fitted in insulated metal cases. These are most useful in such climates, or in mines, where moist conditions prevail, as they may even stand side by side in water without any fear of leakage of current. Another feature in the manufactures of this firm is the substitution f terminal screws fitted horizontally through the carbon plates of their Leclanché porous pots, as shown in fig. 1; thus dispensing with the use of the lead cap. As the terminals are clamped tightly to the carbon plate by the screwed washer, the best possible contact is obtained, and the difficulty of securing a good grip by simply screwing into the carbon from above is avoided.



Figs. 1 and 2.—E.S. Porous Pot and Sac Elements.

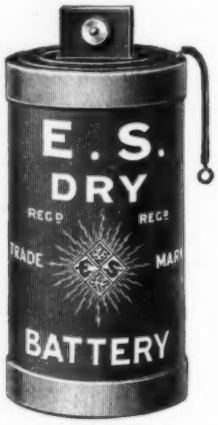


Fig. 3.—Ordinary Type Cell.

The company is also supplying "sacs" which fit into the different sizes of ordinary Leclanché jars, thereby avoiding the necessity for special glassware (fig. 2). Porcelain covers, supplied when required, form a neat finish to the cell, and tend to greatly reduce evaporation—a point of considerable importance in hot climates. Fig. 3 shows a cell of the ordinary type. We understand that one of these made eleven years ago, and kept in store, can still give 3 amperes and ring a bell strongly—admittedly an exceptional example.

An Electric Bath Chair.

In our issue of March 7th, 1916, we illustrated and described the Elieson invalid's electric carriage, the extended use of which was unfortunately hampered by the fact that the Lord Chief Justice had decided that the self-propelled bath chair was a motor car within the meaning of the Act. We are, however, informed that the chairman of the Committee on Road Transport, now sitting to consider the question of regulation and taxation of road vehicles, has promised that the question of removing this anomaly shall be placed before the committee for consideration. Under these circumstances, Messrs. J. & A. Carter, Ltd., surgical engineers, of 2, New Cavendish Street, London, W.1, are placing on the market the Elieson-Carter bath chair, which has taken six years to perfect, and has undergone modification and improvement since our previous description.

It is a comfortable, well-sprung chair, and the control is so simple that the user is rendered independent of an attendant. As will be seen from the illustration, fig. 4, the propelling motor is carried over the front wheels, and the steering is by tiller, which method was adopted for simplicity; the tiller arm folds back so as to be out of the way when alighting from the chair. The battery of accumulators, which is housed under the seat, consists of 24 cells, the voltage of each on open circuit being 2.1; thus the total terminal voltage is 50 volts when standing and fully charged. A distance of 20 miles can be covered on a single charge. A voltmeter and switch are fitted to the footboard next to the charging plug, and the distance travelled can be easily ascertained by reference to the cyclometer fitted to the side of the rear road wheel. A battery cut-out switch and protective fuse are fitted in a convenient position as shown. Next to these the controller handle will be noticed; this gives four speeds, ranging from a crawl up to 5 m.p.h., and it is fitted with reverse on all speeds. To stop the chair it is only necessary to pull the controller handle right back, when the circuit is broken, and at the same time a brake is applied to one of the rear wheels. Under normal conditions this brake

Fig. 4.—The Carter Electric Bath Chair.

suffices to hold the chair, but in addition, a second brake is fitted to the other wheel. The chair is well made and finished, and, as we personally proved it to be, comfortable and well sprung. It should prove ideal for the use of invalids and wounded men.

The Brella Magneto Tester.

The h.t. magneto testing apparatus produced by the Brella Manufacturing Co., Ltd., of 6, Dyer's Buildings, Holborn, E.C. 1, to the design of Mr. A. T. Scorey is a rapid and convenient means of performing tests on all kinds of ignition equipment. It can be operated by a 4- to 6-volt battery, the pressure being stepped up by an internal transformer to the voltage required for magneto testing. The parts to be tested are placed upon an earthed base-plate and the various circuits

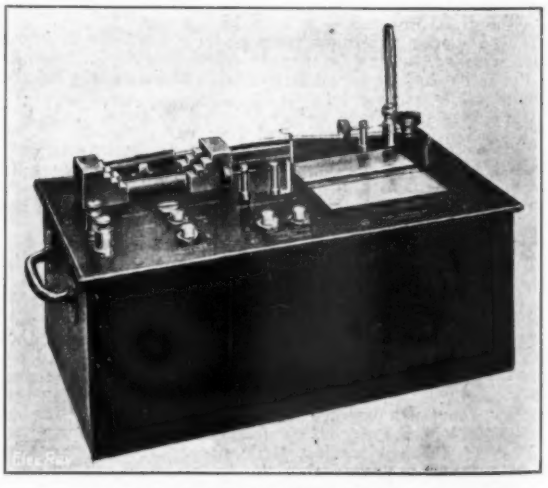


Fig. 5.—Brella Magneto Tester,

are operated by depressing buttons. The detail under test is put into circuit by means of a pointed h.t. test cable. Sparking lugs, armatures, slip rings, collector brush-holders, &c., can thus be easily tested. A magnetometer is provided, consisting of steps varying in height and width apart to accommodate various sizes of magnets. If a magnet is up to fair working strength it will, when placed upon the steps, have sufficient power to raise the magnetometer keeper from its resting place. Wiring tests can also be carried out by means of this apparatus, continuity being indicated by a trembler.

LEGAL.

South Wales Electrical Power Distribution Co.

In the Court of Appeal, before the Master of the Rolls and Lords Justices Atkin and Younger, on December 10th, the hearing was concluded of the appeal by the Attorney-General on behalf of the Crown from a judgment of Mr. Justice Rowlatt refusing a declaration that the issue by the South Wales Electrical Power Distribution Co. of half-yearly deferred warrants to the holders of their 5 per cent. debenture stock was liable to duty under section 8 of the Finance Act, 1899.

It appeared that the company, instead of paying the half-yearly interest on their £200,000 5 per cent. debenture stock in cash, had for about ten years issued every half-year what were called deferred warrants for the amount of the interest, less income tax, the warrants themselves carrying 5 per cent. interest. The question was whether these issues of loan capital within the meaning of the section, which said that loan capital meant debenture stock, &c., or funded debt, by whatever name known, or any capital raised by any company formed or established in the United Kingdom which is borrowable or has the character of borrowed money.

The respondent company was incorporated in 1900, and by its 1906 Act it acquired power to create prior lien debenture stock, and in the event of doing so, to satisfy the interest upon the £200,000 debenture stock for a period of years by the issue of half-yearly deferred warrants payable out of the first available funds of the company subject to prior charges. The prior lien stock was in fact issued, and from January 1st, 1906, to January 1st, 1916, no interest was paid in cash upon the 5 per cent. debenture stock, the deferred warrants being issued instead. Each warrant was stamped with a penny stamp and no stamp duty except that had been paid upon them. The amount involved in the dispute was about £95,000, as being the sum on which the *ad valorem* duty would have to be calculated.

Mr. Justice Rowlatt, in giving judgment in favour of the company, said that all that the company had done by the issue of the half-yearly deferred warrants was merely to give an acknowledgment of interest unpaid, leaving the remedy for it exactly where it was, but adding the obligation to pay the interest. That, in his opinion, did not mean that it became a funded debt, but merely that the stockholder was given a warrant to show what his rights were. From this decision the Crown now appealed.

The Attorney-General, Mr. T. H. Parr, and Mr. Hills (instructed by the Solicitor to the Inland Revenue), appeared in support of the appeal; and Mr. Holman Gregory, K.C., and Mr. T. G. Lewis (instructed by Messrs. Spencers and Evans, of Cardiff), for the respondent company.

Mr. Parr said the appeal raised a short point, viz., a question of construction of a section in the Finance Act of 1899, and it dealt with what was, and what was not, loan capital. If the subject matter which was sought to be charged in the present case was "loan capital" within that section, then the proper stamp duty mentioned by that section attached. The question for the opinion of the Court was whether in respect of a statutory company's debenture stock, if the company in lieu of paying half-yearly interest in cash for about ten years, issued to the holders of the stock deferred warrants for the amount of the interest, such warrants carrying interest at a certain rate, were or were not issues of loan capital. He (counsel) contended they were.

Their lordships in the result affirmed the decision of Mr. Justice Rowlatt, and dismissed the appeal with costs.

The Lobito, Benguella & Catumbella Electric Light and Power Co., Ltd.

In the Chancery Division, on Friday last, Mr. Justice Astbury gave judgment in default of defence in an action brought by Mrs. Johnstone, the holder of £1,400 worth of debenture stock, against The Lobito Benguella & Catumbella Electric Light and Power Co., Ltd.

Mr. Byrne, for the plaintiff, said there were several issues of debenture stock, but the issue of which the plaintiff held a part ranked in priority to all the others, and a sum of £13,200 was now outstanding of that issue, together with a sum of £4,950 premiums on redemption at the rate of £1 7s. 6d. per £1 of stock, and arrears of interest, making altogether £19,000 with current interest. An agreement for the sale of the assets of the company had been sanctioned, and there was now in Court a sum of £24,000 odd.

In reply to his Lordship, Mr. Byrne said there would probably be a small sum over after the claims of the stockholders who had priority over all others had been satisfied.

Scott Anderson *v.* Clayton & Shuttleworth, Ltd.

Mr. Justice Roche in the Commercial Court of King's Bench, on December 10th, concluded the hearing of an action concerning the sale of asbestos-covered electrodes which, in March last, were the subject of a Chancery action before Mr. Justice Younger, who granted a perpetual injunction restraining the plaintiff in this case from selling, or making any profitable use of, any metal-covered electrodes coated or covered wholly or partly with blue asbestos.

The action now before the Court took the form of a claim for "goods sold and delivered," and was brought by Mr. Tom Scott Anderson, of Sheffield, against Messrs. Clayton and Shuttleworth, Ltd., of Lincoln, for the recovery of £750, or in alternative, damages for alleged breach of contract to take the goods.

The defendants, by their counsel (Mr. Raynor Goddard), admitted the claim, but counter-claimed for alleged breach of warranty, and the point for the decision of the Court, said counsel, was the measure of damages which a buyer was entitled to recover where the seller had delivered to him an article which was an infringement of another person's patent so that the buyer was unable to make use of the goods. He contended that the defendants were entitled to recover by way of counter-claim the same sum which they had to pay to the plaintiff. He did not allege consequential damage through not being able to use the goods, but he submitted that as the defendants had to pay the plaintiff £150, the purchase price of the goods, the plaintiff had to pay the defendants back a like amount, in damages. The defendants alleged that plaintiff represented and warranted that the electrodes were not an infringement of anyone's patent, and that he had a right to sell them. It was alleged that the electrodes were an infringement of a patent granted to the Quasi Arc Co., Ltd., and the trouble all arose from the covering being made of blue asbestos.

The plaintiff denied that the electrodes supplied were an infringement of any patent, being covered with blue asbestos fibre, and not blue asbestos yarn.

Mr. Edward Forster (plaintiff's counsel) contended that it did not really matter whether the electrodes were or were not an infringement of the patent, because the property in them passed at a time when there was no question about it, viz., at the end of January, 1918, and when the final date for delivery arrived, March 11th last, the injunction had not been granted. It was not granted until the 19th of that month. He contended that the electrodes were not an infringement of the patent because they were covered with fibre and not yarn.

Mr. Thomas Freestone, analytical chemist, giving evidence in support of the defendants' case, stated that he was in the employment of the defendants, and gave it as his opinion that there was no difference between asbestos fibre and asbestos yarn for the purpose of covering the electrodes. There would, he said, be about two tons of metal in the consignment, and defendants could not make any use of the goods without stripping them, and if they were stripped the approximate value of the metal would be under £10. The stripping would be a costly process, as it would have to be done by hand.

The Plaintiff, while describing the nature of the covering, stated that the injunction was by consent.

In reply to a question by his Lordship as to what he thought the goods were worth to him in their present state, plaintiff said that if he had the iron alone the value would be £45 a ton, and there would be about 3 tons in all.

His Lordship, at the conclusion of the hearing, said that in his opinion the defendants' damages on the counter-claim should be limited to about what it would cost the defendants to obtain a licence from the Quasi Arc Co. to use the goods, and he directed an adjournment of the case to allow of an inquiry being made as to the amount of damages.

The case stood adjourned accordingly.

H.M. Postmaster-General *v.* Blackpool & Fleetwood Tramroad Co.

(County Court Judge's Decision Reversed.)

On Friday last in the Divisional Court of King's Bench, composed of Lord Justice Warrington and Lord Justice Scrutton (sitting as additional judges of the King's Bench Division), this case was argued on the appeal of the plaintiff from a judgment of His Honour Judge Sturges in favour of the respondents at the Blackpool County Court.

Mr. Ross Brown, for the appellants, said this was an appeal from a decision in which the learned judge had held that the Postmaster-General was not entitled to recover expenses to which he had been put in repairing damaged telephone cable at Blackpool, caused, as appellants submitted, by the working of the tramway undertaking of the respondent company at Blackpool. This tramway company ran an electric tramway from Blackpool to Fleetwood, and running almost parallel with that line was the telephone cable of the Postmaster-General. The telephone cable and the line of the electric tramway at a point known as Bispham Point ran within 7 ft. of each other. In the course of the working of the tramway the electric current escaped from the line of the tramway under the cable of the Postmaster-General at Bispham Point, with the result that electrolysis was set up, which eventually caused a corroding of the lead sheeting of the telephone cable. It was a gradual process, and in the course of time there was a breakdown of the telephone cable which appellants said was "an injurious affection of the Postmaster-General's telephone" within the meaning of the Blackpool and Fleetwood Tramroad Act, 1896, and for the expenses to which appellants were put in repairing it they claimed £16 18s. He contended there was an absolute obligation on the part of the respondents under the Act to pay for such repairs.

Mr. RIGBY SWIFT, K.C., for respondents, said the parties agreed that the County Court judge should act as arbitrator in the matter. The learned judge said that he had no jurisdiction to deal with the matter, but that the parties had agreed to waive any question of jurisdiction. Had it not been for that, he (counsel) would have contended that he had no jurisdiction. In those circumstances, when the learned judge had given a decision the other side could not go back on that. It was not suggested the respondents had been guilty of any negligence, and if there had been a suggestion that they had in some way or other constructed or worked their undertaking in a manner they should not have done, the County Court Judge had found that that had not been proved.

Lord Justice WARRINGTON, in giving judgment, said this was an appeal from an order of a County Court judge in Lancashire dismissing a claim by His Majesty's Postmaster-General against the Blackpool & Fleetwood Tramroad Co. The question arose in these circumstances. Under a local Act of 1896 the Blackpool company constructed a tramway which was now worked by electricity along a certain high road. The tramway was constructed in 1898. In the year 1914 the Postmaster-general caused to be laid along the same road a cable for telephone purposes, and at one place the cable came within 7 ft. of the tram line. In the year 1916 there happened a large leakage of electricity from the tram line, and as the result of the electrical action the Postmaster-General's cable was injuriously affected. It was necessary to effect certain alterations with the view of making good what had previously happened, and with the view of preventing it for the future, and the action was brought to recover the expenses incurred. The case, in his opinion, turned upon the proper construction of section 65 of the private Act, and in particular of subsection 2. His Lordship read section 65 which was inserted for the protection of the Postmaster-General, and said if the telegraphic line was injuriously affected by the working of the tramway the Postmaster-General was entitled to recover the expenses of such alterations in the telegraphic line as might be necessary. It was admitted that the telephone cable came within the expression telegraphic line. The subsection appeared to him to give to the Postmaster-General a statutory right to recover the expenses, and for these reasons he thought the judgment of the learned judge was wrong, and that the Postmaster-General was entitled to judgment for £16 18s. and costs.

Lord Justice SCRUTTON agreed.

The judgment of the County Court Judge was therefore reversed.

"NO NOTICE ON EITHER SIDE."

IN the Shoreditch County Court, before Judge Cluer, on December 10th, Winifred Constance Faithfull, of Lewisham, machinist, sued the United Electrical Manufacturing Co., of 22-24, Christopher Street, E.C., ironmongers and electrical accessories suppliers, to recover 28s., being two days' wages, and a week in lieu of notice. The plaintiff said she was engaged in the ordinary way, and worked for four days, when she was discharged at a moment's notice and given two days' money. Nothing was said at all as to the reason for the notice or as to notice. The defendant said the girl had been treated in exactly the same manner as any other girl would have been; she was discharged without notice, there being notices all over the building that no notice would be given or was required of anybody. Judge CLUER: But did you draw her special attention to it? DEFENDANT: I cannot say that she was specially told, but it was everywhere for her to see. Judge CLUER: That is nothing; she might not have been able to read. You can plaster the whole of the walls with these notices, but they have no effect unless you tell the person that is part of the agreement of engagement. No doubt the firm wish to act fairly by these girls, but they must clearly draw the attention of the girl as she is engaged to the terms of the engagement. You must say "these are our terms; do you agree?" Merely putting up the notice is nothing. DEFENDANT: All we wish is a ruling on the point from your honour. Judge CLUER: Then let me tell you that in future to protect yourself you must show the notice which is up to the person you are engaging. You have paid 8s. 2d. into court as full payment, but will have to pay a further 19s. 10d. Judgment was entered accordingly for the plaintiff, with costs.

New Japanese Steel Plant.—Designs have been prepared in the U.S.A. for a steel plant intended for shipment to the Kinshu works at Yawata, Japan, the estimated cost of which is £750,000. The whole plant will be electrically driven. The initial plant will include three 50-ton basic open-hearth furnaces, a 20-unit producer plant, an 84-in. plate mill, and a 24-in. structural mill. Later, a motor-driven, 35-in. blooming mill will be installed. The three basic open-hearth furnaces are served by 12 Smythe gas producers. The 84-in., three-high plate mill, which is nearly ready for shipment, is of the Lanth type, and will be driven by a 2,000-H.P. motor through herring-bone reducing gears and pinions; the motor running at 420 R.P.M. makes the mill speed 56 R.P.M. Since the company has its own blast furnaces, coal and iron ore mines, and fire brick plant in China, it will be the most completely self-contained organisation in the Far East.—*Technical Review.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Patent Office Library.

I have long waited for some protest to be made in the technical Press, such as appears above Mr. Salter's name, with reference to the closing hour of the Patent Office Library.

If any reason existed during the strenuous days of the war for the library to close at 4 p.m., a greater reason exists in the more strenuous days ahead for it to remain open to the latest possible hour.

It is an injustice to restrict the use of the library to patent agents, clerks, and those with sufficient leisure to read during business hours, for from my own observation, which the records of the office can prove, a large number of men took advantage of the evening hours to derive the technical assistance and mental tonic that such a library can afford.

Alfred Braine.

London, N.
December 13th, 1919.

The Electricity Bill and Power and Lighting Regulations.

One thing I certainly do hope will be tackled as soon as the Government has the necessary authority, and that is, the various rules and regulations of the different corporations, power companies, and insurance offices.

As we are situated at the moment, any supplier of power seems to be able to make out a set of rules to suit his own pet fancies. It seems extremely absurd that what is correct for, say, Birmingham and Glasgow, is not in order for Manchester or Newcastle. What it really comes to is that each chief engineer makes out his own set of rules, and the result is that the average manufacturer is in a quandary on the subject generally.

I consider that a set of rules governing power and wiring respectively should be decided on at the earliest possible moment by a responsible authority and act as the governing rules for the whole of the United Kingdom.

The average engineer who has been responsible for the various sets of rules referred to above is apt to look with scorn on the very much out-of-date Electric Lighting Acts that we are still working under, and which have been the cause of so much confusion and holding back of the electrical industry generally, yet in many respects the industry is in exactly the same position regarding these various sets of rules to which I refer. It rather reminds me of the time when engineers in some cases thought they would have a different frequency just so that their name should be known a bit better.

A.M.I.E.E.

December 12th, 1919.

[As we have pointed out, and as was shown in Mr. Charles A. Baker's article in our issues of April 18th and 25th, 1919, most of these sets of rules have no legal authority.—EDS. ELEC. REV.]

Combined Lighting and Ignition Set.

We have just had our attention called to a communication which appeared under the above heading in your issue of the 5th inst. over the signature of a Mr. H. F. Parish, chief designer to a firm manufacturing similar specialities to ourselves.

Mr. Parish evidently was not quite so well versed in the subject as the gentleman responsible for the wording of the article complained of, for when one considers that we patented the type of dynamo and distributor referred to as far back as 1910, and that hundreds of thousands of these combined dynamos and distributors have been manufactured in America during the past eight years under licence from us, one may be forgiven for referring to an exactly similar type of machine only recently introduced by a rival as "similar to the 'C.A.V. machine."

If Mr. Parish would like any further information upon this interesting subject we shall be pleased to furnish him with any particulars, or he might find the files of the Patent Office useful.

C. A. Vandervell & Co., Ltd.

Acton.
December 13th, 1919.

Appointments in India.

I have noticed recently several letters in your columns dealing with the cost of living out East (in India), and perhaps the opinion of one who is out here at present will not come amiss in helping anyone to decide whether it would pay him to come out here at a certain salary. All your correspondents err on the low side with the exception of "G. V. M.," who has also put the social side of the question very clearly.

Rents out here have gone up tremendously since the beginning of the year, and in the European quarter a man

cannot get accommodation under Rs.250 per month. In the Eurasian quarter he will get accommodation from Rs.150 to Rs.190 per month, but if he lives there he will not be tolerated by the Europeans that he may come to know. Mercantile firms will not allow their assistants to live in any but the European quarter. Every man has a different scale of living, and perhaps the following prices will show each one how much his personal expenses will amount to:—

Cigarettes, Rs.2 per 50; tobacco, Rs.1.10 per ½ lb.; beer, Rs.1.8 per pint; whiskey, Rs.0.12 per peg; whiskey, Rs.6 per bottle; white suits, Rs.30 (many are required); boots, Rs.39.8; washing, Rs.9 per month; servant, Rs.25 per month; theatre seat, Rs.5. Carriage hire costs Rs.1 the first hour, 0.8 the second. Taxi, 0.10 per mile.

I would also call your attention to two advertisements that appear in your September 12th issue, which I consider mean getting men out here under false pretences. One is for an estimating engineer, offering Rs.700 per month, and the advert. says this is equal to £700 per annum. As a matter of fact it is only £560 per year. The present rise in exchange ought not to be included in the salary offered, as it is most abnormal, and may drop down to normal at any time.

A similar advertisement is published offering Rs.400 per month, which is said to equal £400 per annum, but is only equal to £320 per annum under normal circumstances.

Bidgley Wolla.

Calcutta,
November 10th, 1919.

I have noticed several letters in issues of your paper on the above, and I would strongly recommend all engineers who contemplate coming out to India to make themselves thoroughly acquainted with the letter signed "G. Y. M." on the "cost of living in Burma," published in your issue dated October 3rd, 1919. I agree with him that conditions in India are practically the same as in Burma.

This is my second visit to India; my first was with the Army in 1914; I then lived as I considered very economically, and it cost me on an average Rs.360 per month for bare living, including part rent of a bungalow. I came out here for the second time last April as an engineer, and I find that prices have gone up since my first visit. At the present moment it is next to impossible to rent a flat in Calcutta for less than Rs.250 per month; the housing problem here is quite as serious as it is at present at home, and even then it is difficult to get a flat to live in, as the place is so full in the European quarter. Furniture is also very expensive, either to buy or hire. Servants' wages, too, are much higher than before the war, roughly 25 per cent. up.

The real purchasing value of the rupee out here is no more than a shilling.

A professional man in India must have at least twice the salary, with prospects, that he would get at home; if he has a family out here, 2½ times, if he is to live up to the same standard of comfort as he did at home and be able to save a small amount per month for emergencies, such as medical attendance or compulsory visits to the Hills, which are very heavy items.

I have seen two recent advertisements in your paper, one offering a salary of Rs.400 per month, and one Rs.700 per month; in these cases, it was stated that these amounts were equal to £400 and £700 per annum respectively. This sounds all right, but it is very misleading, as with very few exceptions everything is charged for at double English prices, and sometimes more.

Once an engineer gets out here he will find it difficult to get a look-in at any job advertised in England should he want to return, as all technical papers are received here a month after publication in England, and in the majority of cases it is then too late to send in an application.

I suggest that city and borough councils and others, when advertising for engineers, might make provision for those in India who would like to apply for a suitable post. The same thing applies to engineers in other distant countries.

Another thing I might add. It is no manner of use a young man coming out to India if he is weakly; and it's no use his coming here in a service or employment which does not offer good future prospects. I suggest he should take all the advice he can of disinterested persons, and consider the question well, and what it will mean ten years hence.

Everyone, or almost everyone, gets a living wage when he comes out. People have to give him that to get him. The future is a very different matter.

Herbert W. Watts.

Calcutta.
November 11th, 1919.

[We are much indebted for this information to both our correspondents. Mr. Watts, we understand, is willing to give further particulars to engineers who wish for them.—EDS. ELEC. REV.]

Rewinding Induction Motors.

Having purchased a number of 3-phase, 50-cycle induction motors with squirrel-cage rotors, I would like to alter the stator windings. In some cases the speed is correct, and the voltage wrong; in others it is *vice versa*. Some motors are star-delta, others star-connected. It is desired to work all motors rewound with star-delta starters.

Possibly some kind reader who has had the same difficulty would favour me with a worked example, which would be greatly appreciated.

Rewind.

Ultra-violet Light Rays.

I am anxious to get into communication, if possible, with the makers or factors of glass globes made from special glass which will absorb the ultra-violet rays without serious coloration or loss of visible light, and shall be very much obliged if you or any of your readers can assist me.

Light.

December 12th, 1919.

[At the British Scientific Products Exhibition last year, Sir William Crookes's special glasses were shown; they were made by the Anti-Glare Glass Co., and were suitable for spectacles. Ordinary glass is practically opaque to ultra-violet light below 300 millimicrons wave-length.—EDS. ELEC. REV.]

BUSINESS NOTES.

Cost Accountants' Meeting.—As we were only able to very briefly announce last week, the inaugural meeting of the Institute of Cost and Works Accountants, Ltd., was held on the 17th inst. in London. It was in the early part of this year that the movement was commenced to form into an Association all those who were engaged in occupations requiring a mathematical and technical knowledge of costing, and to embrace cost accountants, works accountants, estimating and cost clerks, with a view to secure for them a definite professional status.

The Institute has been formed to promote the higher efficiency of those engaged on this special section of manufacturing, to assist its members by mutual interchange of information and ideas. It has Lord Leverhulme as president.

The offices of the Institute are at Donnington House, Norfolk Street, Strand, W.C. 2, where the secretary will be prepared to give any information.

Standardisation of Chains.—We learn that the Association of British Driving Chain Manufacturers has now completed the standardisation of roller chains and wheel-tooth forms. The Association standard chains of 1 in. pitch and upwards, as used for automobile and general engineering transmissions, will be available during 1920. Full details of the complete standardisation of roller chains are now published in pamphlet form. Applications for copies may be made to the Secretary, Association of British Driving Chain Manufacturers, Bassishaw House, Basinghall Street, London, E.C.2, or to the following members:—Brampton Bros., Ltd., Birmingham; "The Coventry" Chain Co., Coventry; Hans Renold, Ltd., Manchester; Alfred Appleby Chain Co., Ltd., Birmingham; Perry & Co., Ltd., Birmingham.

American Bankers' Opinion on the Electric Light and Power Industry.—According to the *Electrical Review* (Chicago), the Public Utility Securties Committee of the Investment Bankers' Association of America, makes the following statement, in its annual report, relative to the electric light and power industry:—"It should not be difficult to educate the public to renewed and increasing confidence in an industry which has proven itself, even in the crisis of war, so stable, resourceful, resilient and productive, and which offers convincing promise for safe and remunerative employment of enormous additional capital."

Train Lighting in Australia.—From Mr. A. H. Darker, A.M.I.E.E., manager and engineer of the electrical department of Messrs. J. Stone & Co., Ltd., who is on a business visit to Australia, we have received particulars of the latest sleeping cars which have just been built in Victoria for the long journey between Melbourne and Adelaide, which are 71 ft. long and weigh 40 tons—two tons per passenger. Similar cars are being built for the Commonwealth Trans-Australian Railway, and all these, as well as the new carriages on the South Australian Railways, are equipped with the Stone system of electric lighting. As the journey from Perth, W.A., to Adelaide occupies 69 hours, the necessity of thus providing for the comfort of the travellers will be appreciated. The sleeping compartments have two lamps for general lighting, and each berth is provided with a reading lamp. Numerous depôts have been established for the maintenance of the lighting system, the large number being necessitated by the many breaks of gauge. The firm is to be congratulated on having been able to resume its commercial work directly the war was over, and to secure these orders in the face of the world's competition. All the material was supplied from the Deptford works of the company.

Canadian Trade Information.—During the war the activities of the Bureau of Canadian Information, which was established several years ago by the Canadian National Railways, at 42-45, New Broad Street, London, E.C. 2, were necessarily curtailed. Interest in Canadian affairs has rapidly revived in the past few months, and inquiries are received not only from people who contemplate settling in Canada, but from manufacturers seeking Canadian markets and from buyers in this country looking for Canadian products.

An Annual Trade Review.—Messrs. Bolling & Lowe, Ltd., of 2, Laurence Pountney Hill, London, E.C. 4, have issued their Trade Review for the year, in the course of which they state that never in the history of the iron, steel, and allied trades has the future, and more especially the near future, been so full of promise as it is to-day, owing to the world's depletion of all stocks. Labour, however, gives cause for anxiety on account of its unreliability, and does not appear to realise that one and all engaged in industry, in whatever capacity, whether employer or employed, must work conscientiously. Failing this, the prosperity that lies within its grasp will be lost.

Orders and inquiries for railway, shipbuilding, and constructional material for home consumption, and, perhaps, in a still greater degree for export, are, we think, unprecedented, and as it is the latter which is most important for the country's benefit, it should be specially favoured. . . . .

In Australia, India, and South Africa the increased production of rolled iron and steel must have an effect on future requirements from this side, although not, we anticipate, for some years to come will they manufacture sufficient material to cover the growing demands of their increasing populations.

The following comparison of prices is given :—

	January 1st, 1919. Per ton.	December 11th, 1919. Per ton.
Pig Iron :		
Hematite.. ..	£8 12 6	£10 5 0
Foundry	7 5 0	8 5 0
Copper	112 0 0	101 0 0
Tin	235 0 0	206 10 0
Lead	39 0 0	41 10 0
Steel :		
Ship plates ..	16 10 0	23 0 0
Angles	16 2 6	19 15 0
Bars	17 10 0	22 10 0
Joists	16 2 6	19 15 0
Heavy rails ..	15 10 0	16 15 0
Galvanised sheets :		
24 gauge.. ..	31 10 0	40 0 0
Tinplates :		
Cokes, 20" × 14"	1 12 6	2 6 6 per box.

The conditions in the iron and steel trade in Germany appear to be getting worse rather than better, and works are finding it increasingly difficult to obtain raw material in sufficient quantities and at reasonable prices. They are unable to enter the export market with any considerable tonnage, and from latest information received we think many months will elapse before this condition radically alters.

The United States is in the throes of labour troubles, which have been anticipated for many years, and it is quite likely that industrial unrest will recur. . . . .

To buy to-day from America steel and many other manufactures is now almost prohibitive, and unless the Americans purchase from us and Europe generally, and our "invisible exports," freights, insurances, and banking profits are taken advantage of, her exports of everything, except absolute necessities, will disappear, with the paradoxical position that the richest country in the world will largely be unable to trade.

At present Germany is not a serious competitor in South America, and it is "up to" our manufacturers to assist the merchants in expanding a valuable trade, which before the war was not increasing as rapidly as it should. The buying power of the Argentine, Brazil, Chile, &c., is great, and will be greater, consequently our best efforts should be made promptly.

The report concludes :—

This is an age of amalgamations—banks, insurance companies, industrial manufacturing concerns, as well as labour, taking the lead. If such are benficial, it is singular that merchant firms have not, so far, participated in this movement. . . . .

The people in this country are awake, and the only thing necessary for success is for all to put their shoulders to the wheel of industry and work in harmony to secure the blessings of peace.

Non-Ferrous Materials.—The following are particulars of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on December 1st, 1919 :—

Copper	14,867 tons	Soft pig-lead	59,912 tons
Spelter (G.O.B.)	12,848 ,,	Nickel	1,800 ,,
,, (refined	10,940 ,,	Antimony regulus ..	2,959 ,,
Aluminium	8,911 ,,		

A proportion of the above stocks is already sold to the trade for forward delivery.

Bankruptcy Proceedings.—Cecil Hellyar (trading under the style of A. Parker & Co.), electrical engineer, &c., 130, Upper Richmond Road, East Sheen, Surrey.—This debtor applied on December 8th at the Court House, Garratt Lane, Wandsworth, for his discharge from bankruptcy. The Official Receiver reported that the receiving order was made on February 13th, 1906, on a creditor's petition, but was varied on March 21st, 1912, to exclude Alfred Parker Jones from the proceedings on the ground that he was an infant when the petition was presented. The order of adjudication was made on February 20th, 1906, against both Alfred Parker Jones and Cecil Hellyar, but the order against the former was annulled on March 21st, 1912. The Official Receiver remained trustee of the estate. In reply to the Official Receiver, debtor said his present occupation was that of an electrical engineer, and he was receiving a salary of £5 a week. He had some shares in an engineering company, but they had been sold. He had tried to make an arrangement with the creditors in his failure, offering 6s. 8d. in the £, but this did not go through. Debtor's solicitor suggested that the failure was the result of the folly of youth. The two young fellows did not realise how to carry on a business like theirs. Debtor, although a bad trader, was a very clever man. He had materially assisted the Government during the war as he had invented an electrically-heated suit to enable airmen to fly at a height of 20,000 ft. He had, however, not got his due reward. The discharge was granted upon debtor's consenting to judgment of £50 to be paid over to the Official Receiver.

French Electrical Companies.—Under the style of L'Electricité Appliquée has been formed at Paris, a company with a capital of 350,000 fr., for the carrying out of electrical installations of all kinds, including the manufacture of electrical apparatus.

The Société Artésienne de Force et de Lumière has just raised its capital from 5,200,000 fr. to 8,000,000 fr.

Our Trade in India.—There has been issued a "Report on the Conditions and Prospects of British Trade in India at the Close of the War," by Mr. T. M. Ainscough, O.B.E., His Majesty's Senior Trade Commissioner in India and Ceylon. The report impresses upon British manufacturers and exporters the recent important and far-reaching changes in the import trade of India, which call for special efforts and revised methods and organisation on the part of British traders. It is the first prepared by a Trade Commissioner in India, and is divided into five parts, the first of which contains a general survey of the industrial and commercial position obtaining in India immediately prior to, and during the war, with particular regard to foreign competition, the development of Indian industries, the attitude of the merchant houses, and the question of manufacturers' branches in India. A detailed examination of the leading import trades, with special reference to the changes in character, volume and origin of imports during the years of war, will be found in the second part, while the third part embodies a review of the methods of representation and distribution in India in particular trades, together with definite recommendations as to the revised methods which might, with advantage, be adopted by British interests in order to meet the new conditions. The fourth part of the report treats of the development of Indian industries and its significance, with special reference, first, to the opportunities for the employment of British capital and industrial management in the country, and, secondly, to the readjustments which will probably be necessary in some of our export trades as the result of the competition of local industries. We hope to refer more fully to the report in a later issue.

The German Glow Lamp Industry.—It is stated that the glow lamp works of the A.E.G. and of the German Incandescent (Auer) Light Co., the amalgamation of which was recently announced, are to be transferred to a separate company with extremely limited capital. The working capital is to be provided in the form of credits to be granted by the A.E.G. and the Auer Co., and possibly also by the Siemens-Schuckert Co.

Instalments on German Orders.—The German electrical firms who are members of the Price Regulation Department of the Central Union of the German Electrotechnical Industry have decided henceforth not to accept orders except on the payment of a non-interest-bearing instalment amounting to from one-third to one-half of the value of the order prevailing on the day when the order is framed. An exception, however, is to be made in the case of customers in a small way of business.

The Charleroi Electric Construction Works. — The shareholders in the Ateliers de Constructions Electriques de Charleroi recently met in extraordinary meeting, when the chairman (M. Empain) stated that since the last assembly the directors had devoted their activity to the recovery of the plant which had been removed, and to the reorganisation of working. The equipment in the old works, which was requisitioned by the Germans, had been increased since the Armistice, and now possessed more machine tools than in 1914. In the new works the machine tools in operation were now almost as numerous as in 1914, and new machines were expected to arrive from America, whilst the return of machinery from Germany was proceeding regularly. Apart from certain machines which were in Austria, it had been possible to recover almost all the machinery carried off from the cable factory, and the equipment at the signal works had been augmented since the Armistice. Under the circumstances, the workshops had now been able to resume almost the normal rate of working ; the number of workmen, which was about 3,000 in 1914, was now 2,600, and would be shortly increased. The orders booked since the beginning of the year represented 26,500,000 fr., exclusive of arrears of orders in 1914-19 for from 5,000,000 to 6,000,000 fr. It was proposed to extend the signal department and transfer it to the district of Liege, to extend the shops for the construction of large motors and lifting plant, to develop the cable factory, to undertake the production of insulating tubes and insulating materials, and turn out small motors in bulk. In order to proceed with these developments, it is intended to increase the share capital from 20,000,0000 fr. to 40,000,000 fr.

Electrical Prices in South Africa. — The *South African Mining and Engineering Journal* (November 15th) says :—"Lamps, which are selling here at 2s. each, are fetching in London 3s. 6d., which means, of course, a further rise in these in the very near future. Ceiling roses are in London 1s., which is about the same price as that obtaining here, when any are procurable. Lampholders are also going at 1s. in both London and Johannesburg. As a matter of fact, many electrical materials are fetching at the present time double the price in London as compared with Johannesburg, but then it must not be forgotten that we have been importing electrical goods from America and Japan."

Merchandise Marks.—The Merchandise Marks Committee, who are considering the questions of indications of origin on goods and of national trade-marks, met at the Board of Trade Offices on Thursday and Friday, last week, under the chairmanship of Mr. Harry Greer, M.P. Evidence was given regarding the present position of the matters into which the Committee are inquiring, in so far as those matters affect the Board of Trade and the Customs, by Mr. H. Fountain, C.B., C.M.G., an Assistant Secretary of the Board of Trade in charge of the Commercial Relations and Treaties Department ; Mr. Temple Franks, C.B., Comptroller-General of Patents, Designs and Trade Marks and Comptroller of the Industrial Property Department of the Board of Trade ; and Mr. J. L. Mackie, an Assistant Secretary of the Board of Customs and Excise.

The Swiss Bank's Depreciated Assets.—The accounts of the Bank fur Elektrische Unternehmungen, of Zurich, for 1918-19, which were recently summarised in this journal, were passed without discussion at the annual meeting. As a result of the decline of all foreign exchanges since the end of June, and the consequential depreciation of the securities dealt in on the Stock Exchanges in Switzerland, the directors of the Bank prepared for the meeting an intermediate balance-sheet closed on November 28th, showing a depreciation of the book value of the assets amounting to 82,460,000 fr. (£3,298,000). After transferring 10,000,000 fr. from the reserve fund, and taking advantage of the exchange guarantees, which were arranged a year or two ago, totalling 46,120,000 fr. (£1,844,000), the deficiency of 22,640,000 fr. (£905,000) shown on June 31st, 1919, becomes increased to 48,980,000 fr. (£1,959,000) on a share capital of 75,000,000 fr. (£3,000,000).

Dutch Motors and Dumping.—The Elektromotoren Fabriek Dordt, of Dordrecht, has just declared a dividend, at the rate of 7½ per cent. for 1918-19, as compared with 25 per cent. in the preceding year. The directors' report, which refers to the purchase of raw materials (dynamo sheets and copper) from the United States and England, states that the demand for electric motors would increase enormously through the continual extension of municipal and provincial stations, and the company would secure a share in the business if the prices were able to compete with those of rivals, which would be the case with free and equal competition. It would, however, be otherwise if foreign exchange manifested its influence. In this connection it is mentioned that foreign machine tools of reputed makers were already being offered in Holland at prices which were far below those at which Dutch firms would ever be able to produce them. So far the imports of electric motors were inconsiderable, although some foreign makers were already offering motors at very low quotations. It remained, however, for the future to decide how far the "exchange danger" could cause prejudice to Dutch industry.

Calendars, &c.—From the Pirelli-General Cable Works, Ltd., of 144, Queen Victoria Street, London, E.C., we have received a pocket memoranda book, with celluloid covering, whereon a calendar for the New Year is printed; also a very useful desk memoranda block, with hinged metal case containing monthly calendar slips for 1920.

Sale of German U-Boat Machinery.—Messrs. John M. Leeder & Son, at the Riverside Wharf, Swansea, on Tuesday morning, offered for sale by public auction, motors, electrical equipment, ventilating, heating, pumping, and air-compressor plant, and machinery, taken from dismantled German submarines.

The lots included reciprocating oil pump (£20), small motor-driven air compressor (£13), five-blade single-pole knife switches (up to £5 each), four automatic circuit-breakers (£12), three double-acting plunger pumps (£45 each), motor-driven four-stage air compressor (£200), enclosed auxiliary switchboard to control motors (£20), searchlight with shutters, suitable for signalling (£10). All machinery was made by German firms, some of it as recently as 1916. The largest buyers were Messrs. Graesser, Ltd., chemical manufacturers, Ruabon, North Wales. The total proceeds are expected to realise between £7,000 and £8,000. The lots offered on the second day were mostly motors. Combined motor-generators ranged between £7 10s. and £32 10s.; a combined motor-driven four-stage air compressor, of 21 to 25 H.P., realised £125; a watertight D.C. motor, by Siemens-Schuckert, Berlin, £25; motor or generator, made in 1916, £425; two switchboards, £25 each; three motors, each with two 12-in. shaft extensions, and made by Siemens-Schuckert, Berlin, went for £40 each.

Trade Announcements.—Messrs. Watson & Sons (Electro-Medical), Ltd., of 43, Parker Street, Kingsway, London, W.C. 2, announce that, owing to the increasing demand for their instruments necessitating additions to their staff, Mr. Howard C. Head has joined the board. Mr. Head's experience extends back to the discovery of X-rays in 1896, and he has been in charge of the X-rays and electro-medical department of Messrs. Siemens Bros. & Co., Ltd. Messrs. Watson are also making other additions to their scientific, technical, and experimental staff.

The Sloan Electrical Co., Ltd., of 12, Golden Lane, London, E.C. 1, have been appointed sole agents for the district for Messrs. Peyton & Peyton, Ltd., Bordesley Works, Birmingham, manufacturers of decorative electric light fittings. The Sloan Co. are furnishing a showroom, which they contemplate will be completed early in the New Year, where they will exhibit all types of their fittings. A new catalogue is being compiled.

Messrs. Phillips & Turner, of 115, Edmund Street, Birmingham, are manufacturing galleries of all types for glass shades.

The *Financial Times* states that a new company is being formed by J. G. White & Co., Ltd., called the Consolidated Construction Co., to amalgamate the contracting businesses of Dick, Kerr and Co. and J. White & Co., with offices at 9, Cloak Lane. The English Electric Co. is interested in the new Construction Co. by an acquired holding of ordinary shares of J. G. White & Co. The latter company is unchanged in management and will continue to carry on its functions of engineering and operating management at the same address.

International Exhibition at Lille.—With a view to affording help towards restoring the industries of the devastated parts of Northern France, the Municipality of Lille is proposing to hold an international exhibition next year, from May to October. Its offices are at 20, Rue Henry Kalle, Lille.

Catalogues for Antwerp.—H.M. Consul-General at Antwerp (Mr. M. Gurney, C.M.G.) has recently written to the Department of Overseas Trade to the effect that in view of the forthcoming transfer of the Consulate-General to more commodious premises, it is desired to obtain the supply of a larger and more varied collection of trade catalogues and samples than is available at present. In the new offices a large room is being set aside solely for the exhibition of British trade catalogues, &c., and it is hoped that it will be possible to keep this room well provided with printed matter and small samples covering as far as possible the greater part of British industries. Catalogues, &c., together with a notification, should be posted direct to His Britannic Majesty's Consul-General, British Consulate-General, Antwerp.

Book Notices.—*Apprentice Training.* Booklet No. A G 102 of the British Thomson-Houston Co., Ltd., Rugby.—This volume, which is handsomely produced and illustrated with excellent photogravures of the exterior and interior of the B.T.H. works, as well as of Rugby town, gives particulars of the various courses of training which are offered by the company, under the broad headings of "Trade Apprentices," "Drawing Office," "Engineering," "Student," and "Chemist Apprentices," corresponding to the preliminary qualifications and professional aims of the entrants. No premiums are required in any of the courses; thus there is equality of opportunity, and merit is the qualifying factor, boys who show exceptional ability in the lower grades being eligible for transfer to higher grades. The indentures generally cover a period of six or five years from the age of 15 or 16, and the apprentices are paid at rates increasing yearly, together with an annual bonus, depending on the monthly reports of the foremen and the apprentice supervisor. Close observation of each apprentice's progress is maintained, and each year at least two trade apprentices are promoted to the engineering or D.O. Course. Attendance at "Further Education Classes" is required in the last-named grades, but in the "Student Apprentice" grade the degree or diploma of a university or college must be held by the candidate, and the indenture is for three years only. The "Chemist" course is open to both sexes. Information is given as to the educational facilities provided by the local authorities, the arrangements for the supervision and welfare of the apprentices, the rules, &c., and the works, which at present accommodate about 5,500 employés. An interesting chart shows graphically the courses followed by apprentices in the different categories. The system appears to be as admirable as the manner in which it is presented to the reader—and that is high praise indeed.

Circular of the Bureau of Standards, No. 75, "Safety for the Household." Washington: Government Printing Office. Price 15 cents.

"The Present Position of the Theory of Ionisation." A general discussion reprinted from the *Transactions* of the Faraday Society. Vol. XX, Part 1. 1919. London: The Faraday Society. Price 12s. 6d.

"Safety First."—The London "Safety First" Committee, 31, Westminster Broadway, S.W.1, has issued a poster giving instructions to drivers of electric (storage battery) vehicles, which, if acted upon, will tend to lessen the number of accidents which occur in this direction. The publication is well set out and illustrated.

F.B.I. Trade Commissioners.—In pursuance of its policy of placing Trade Commissioners in foreign countries, the Overseas Committee of the Federation of British Industries has made the following appointments:—

Italy.—Mr. Ed. H. Capp—Mr. Capp was previously the secretary of the British Chamber of Commerce for Italy, whose headquarters were at Genoa, with other offices at Milan and Rome. He will open an office for the Federation of British Industries at Milan at an early date.

Portugal.—Mr. G. L. Barley—Mr. Barley has a very full knowledge of Portugal. His address will be c/o Messrs. Rugeroni & Rugeroni, Ltd., Rua 1° de Dezembro 82/84, Lisbon.

Algiers.—Mr. F. Dorrien Thoroton—His address will be Federation of British Industries, 6, Rue De La Liberte (Cox & Co.), Algiers.

Near East (Constantinople)—Captain Lafontaine, who is well known in Constantinople, represented a well-known firm in this area. He will open an office for the F.B.I.

Catalogues and Lists.—The Metropolitan-Vickers Electric Co., Ltd., Trafford Park, Manchester.—Pamphlet (Envelope Series 4,047/1 B) dealing with the Westinghouse brake solenoids for A.C. and D.C. working.

Messrs. Ward & Goldstone, Ltd., Sampson Works, Salford, Manchester.—Edition A 19 of "Electrical Novelties and Sundries," a comprehensive list of electrical appliances of British manufacture, chiefly devoted to lighting equipment.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, W.C. 2.—Priced pamphlet illustrating the "Sunco" vacuum cleaner.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—"Installation News," December, 1919, describing among other things the manufacture of "Simplex" conduits, and the new "Simplex" fuse unit, which embodies several novel features.

Messrs. R. B. Hand & Co., Ltd., 63, High Holborn, W.C. 1.—Pamphlets illustrating the "Evinrude" oil engine.

Stanton Ironworks Co., Ltd., near Nottingham.—December stock list of cast-iron pipes.

The A. & A. Electrical Co., Ltd., 13, Farringdon Road, E.C. 1.—Illustrated price-list of electric-light bulbs—mainly for car lighting.

Causes of Unrest.—About 4,000 workers in the Tata works at Bombay came out on strike for a bonus on the occasion of the owner of the mills being presented with a son. The rumour was denied, but the workers announced that, baby or no baby, they intended to have the bonus.—*Financial Times.*

St. Dunstan's Day.—In connection with the effort to place St. Dunstan's Hospital on a firm and permanent basis, and give after-care to men who were blinded in the war, Mr. C. E. Town writes offering to supply to any reader quantities of special adhesive Dunstan's Fair Stamps, in sheets of 72, for retention or disposal. The fund is being raised in aid of the Blinded Soldiers' and Sailors' After-Care Fund (13, Walbrook, E.C. 4).

Italian Industrial Exhibition.—An exclusively national exhibition is to be held in Rome in the course of next year, to set forth the progress made by Italian labour in all branches of industry. It is styled a National Exhibition of Work, and the country's advances in the domain of electricity, electrotechnics and electrometallurgy, will be fully shown.

Profit-Sharing and Labour Co-Partnership.—We have received a copy of a pamphlet (3d. net) published by the Labour Co-Partnership Association, 6, Bloomsbury Square, London, W.C. 1, containing speeches by the Right Hon. Lord Robert Cecil, M.P., and the Right Hon. J. R. Clynes, M.P. These speeches reflect the modern aspects of profit-sharing and co-partnership, and illustrate the changed attitude of many public men towards industrial problems. The human side of industry is recognised as of fundamental importance for the progress of industry and for the welfare of the State. We commend the speeches to the careful and sympathetic study of all connected with industry who are anxious to know the merits of partnership as a means of promoting industrial harmony and prosperity. In the pamphlet cross-headings and special type are used to bring out the salient points, and so enable the inquirer to find quickly whatever is to him the particular point of interest. Copies of the pamphlet and other literature on the subject of co-partnership can be obtained on application to the above address.

The Coal Bill Dropped.—The Government has dropped the Coal Industry (Emergency) Bill, which limited the profits of coalowners to 1s. 2d. per ton.

Patents for Inventions.—At the annual general meeting of the Inventors' Union, held in London on Monday last, it was decided to ask the Government to consider the creation of an All-Empire Patent to replace the present system, and a resolution was passed opposing Clause 8 of the Patents and Designs Bill.

Economic Effect of the 44-Hour Week.—The Shipbuilding and Engineering Trades Federation have appointed a Committee of six to co-operate with an equal number of representatives of the Engineering and Shipbuilding Employers' Federations to investigate the economic effect of a 44-hour week in those industries. The men's Committee is composed of :—Messrs. J. T. Brownlie (chairman), John Hill (boilermakers), W. F. Dawtry (steam-engine makers), J. Rowan (electrical trades), J. E. Davison, M.P. (ironfounders), and J. W. Paterson (carpenters and joiners).—*The Times.*

Vickers, and Brown, Boveri.—The *Financial Times* reports that an extraordinary general meeting of the shareholders of Brown, Boveri & Co. was held in Baden, in Switzerland, on December 1st, at which sanction was given to the recent increase of capital and the scheme for a community of interests with the London firm of Messrs. Vickers was approved. Sir Ernest Hiley and Mr. Francis Barker, of the firm of Vickers, and M. Guillaume Pictet, banker, of Geneva, were elected members of the board of Brown, Boveri.

The Ironmoulders' Strike.—In the course of a communication to the Press last week, Mr. D. A. Bremner, Director of the British Engineers' Association, wrote :—"The ironfounders' strike makes no direct and immediate appeal to the man in the street. Nevertheless, it would be difficult to exaggerate the extent to which the national life and welfare are menaced by the stoppage of the production of iron and steel castings. That stoppage, if continued even for another two or three weeks, will paralyse the greater and most important part of the engineering industry of this country, and throw out of employment the great majority of the workpeople engaged in it. Unless this strike be ended very soon the consequential unemployment will run into hundreds of thousands. The very enormity of such a state of things and its disastrous possibilities should induce even organised labour itself seriously to consider whether it can afford to perpetuate it with any regard for its own interests."

Wages of London Electricians.—The London District Committee of the Electrical Trades Union, on December 11th, discussed the employers' latest offer of 2s. per hour, which was not considered satisfactory. The Committee repudiated the suggestion that it was likely to cut off the electricity supply of London at a moment's notice. Instructions have been issued to members of the Union that the rates must be as follows :—Electricians, 2s. per hour, plus 12½ per cent., and mates, 1s. 7d. per hour, plus 12½ per cent. of total earnings, pending the putting into effect of the result of the ballot, which by a large majority gave the Committee the power to call a strike.—*The Times.*

Liquidations and Dissolutions. — Zodiac Peerless Electric Lamp Co., electric light factors, 25, Denmark Street, Charing Cross Road, W.C. Messrs. J. and J. J. Symons have dissolved partnership.

Beck Engineering Co., Eden Works, High Road, Hayes End, Middlesex. — First meetings of creditors and contributories, December 22nd, at Carey Street, W.C.

Committee on Colonial Development.—The Secretary of State for the Colonies has appointed an Advisory Committee to inquire into the opportunities of economic development in the Colonies and Protectorates, to make recommendations as to the principles and methods to be followed in such development, and to examine and report on any particular schemes and suggestions which may be submitted to them.

LIGHTING AND POWER NOTES.

Aberdeen.—New Plant.—The Corporation electrical engineer is to obtain estimates for increasing the condensing plant.

Mr. J. H. Rider has submitted to the E.C. a detailed report on the Corporation electricity undertaking. On the assumption that the Electricity (Supply) Bill will pass into law, it will be for the Corporation, he suggests, to submit to the Commissioners a proposal to constitute Aberdeen and the surrounding district as a separate electricity district, a scheme for the proper supply of electricity in that district, and a scheme for the establishment of a joint electricity authority for the district. Mr. Rider suggests that when the Bill becomes law, the Corporation should take steps to be constituted the electrical authority for the district. It might be necessary to come to terms with Duncan's E.S. Co. with regard to the supply to Ellon, and, perhaps, buy out that undertaking. Mr. Rider discusses the proposals of the Water Power Resources Committee with regard to Lochs Ericht, Laiden, Rannock, and Tummel. As to what it would cost to transmit the energy from the Loch Tummel district to Aberdeen, and working on the hypothetical case that the Corporation would take 9,500 kw., he points out that the transmission line would be about 90 miles long. A duplicate line would be necessary to ensure continuity of supply. He estimates the cost of that portion of the line that would be chargeable against the Aberdeen supply at about £300,000, and if the whole cost had to be charged to Aberdeen, it would amount to about £500,000. The proper way for the Corporation to utilise the energy derivable from a water power scheme would be to use it to supply the whole of the load demand below 9,500 kw., and to use the local steam plant as a supplementary source of energy when the demand exceeded that figure.

The possibilities of obtaining power from the river is now being considered by the water and the electrical engineers.

Australia.—Sydney.—The total commitments of the electricity department amounted to £3,500,000 up to September 23rd last, and will reach a total of £4,000,000 by March, 1920.

Tasmania.—The Mount Lyell Co. is negotiating with the State Government for a supply of power for the treatment of West Coast ores.

Brynmawr.—Prov. Order.—The U.D.C. is to apply for a prov. order to supply electric light.

Burton-on-Trent.—Loan.—The T.C. has applied to the M. of H. for a loan of £6,000 for the provision of electricity for power at the Milton waterworks.

Carnarvon.—Losses in Working.—The chairman of the E.C. states that the company generating power, under an agreement with the T.C., is working at a loss. In spite of this, the Committee is of the opinion that the undertaking is of great advantage to the town, and proposals for a supply from the North Wales power station were not favourably received.

Cavan.—E.L. Scheme.—The detailed estimate for the installation to be made by the new E.L. and P. Co. is now given at £8,035, including duplicate plant at a probable cost of £2,000. Mr. J. J. Woods, Clones, has been appointed engineer to the scheme.

Continental.—France.—A very important group is, says *l'Electricien*, engaged in working out the plans for a transmission line, which will link up the hydro-electric works of the Pyrenees and the Central Plain with the coal-generating stations of the Nord. The Central Plain and the Pyrenees possess considerable water resources, but of variable output. These two regions are, therefore, able to complete each other, while the coal generating stations of the Nord are available when the former have reached their maximum. The conductors, it is believed, will be of aluminium. The Pyrenees-Centre-Paris-Nord line will serve not only the actively industrial Pyrnean region, but the whole of the industrialised middle districts, and also Paris. It will facilitate the electrification of the four networks, the Midi, the State, the P.O., and the Nord, constituting under the control of the State, a steady and sure source of energy.

Italy.—The Government is proposing to grant a concession to an American syndicate to utilise the water powers in South Tyrol on condition that electric energy is supplied to the Italian State Railways at a 10 per cent. addition to cost price.—*Economic Review.*

Slovakia.—In conjunction with the Czecho-Slovak State and the Ministry for Public Works, a company is being formed in Banska Bistritz to undertake electrification in Central Slovakia. The capital is Kr. 10 mill., of which the State will contribute 2 mill., the State mining works 2 mill., and certain towns and communes 2 mill.—*Economic Review.*

Clacton-on-Sea.—Price Increase.—The U.D.C. has increased the price of electricity by 1d. per unit, to 8d., for ordinary lighting, as from the end of the year. The rates for power and heating remain unaltered.

Deal and Walmer.—Time Extension.—The B. of T. has extended the time until March 1st, 1920, of the Deal and Walmer Gas and Electricity Act, 1914.

Doncaster.—Loan.—The Corporation is applying for powers to borrow £40,000 to extend its generating station, and the application was, on December 11th, inquired into by Colonel T. C. Ekin on behalf of the M. of H.

Dublin.—The Corporation refused the Lighting Committee power to exceed its estimate in order to meet complaints about badly-lighted areas. Alderman Byrne said the conditions were, in some instances, disgraceful.

Glasgow.—Mercury Vapour Rectifiers.—In connection with the engineer's recent visit to the Brown, Boveri works, Switzerland, it is reported that during the visit rectifiers were seen in course of construction for pressures of 500 volts in sizes of 170, 330, and 660 H.P. The workmanship was excellent in every detail, and evidence was given that where plant had been in use for five years, when dismantled, it showed no trace of depreciation. At Schliren an installation of two cylinders was seen, each of 170 H.P., for supplying energy to the local tramways. At Berne four cylinders, each of 330 H.P., were inspected, supplying both light and power from a municipal sub-station. The apparatus was seen disconnected and re-started within five seconds. At Le Locle four cylinders, each of 170 H.P., were examined. From Neuchâtel, Peter's chocolate factory at Orbe was visited, where two cylinders, each of 330 H.P., were seen supplying both light and power in the factory. The small space occupied by the plant in front of the switchboard was specially noticeable in this case. At all the foregoing installations assurances were given by directors, managers, and workmen in charge of the plant, that the performance of the rectifiers was entirely satisfactory. A very large installation of rectifiers is being considered for Paris, and Zurich is also to have an installation. No examples of these rectifiers are at present in use in Great Britain, but a list of 60 installations was supplied which have been carried out during the past five years, representing a total of 100 cylinders and a capacity of 25,000 H.P.

Hastings.—Loan.—The T.C. has applied for a loan of £6,041 for H.T. cable.

Hull.—Fuel Shortage.—Owing to the serious situation arising through the coal shortage, the Fuel Overseer has made an order prohibiting all outside and inside display lighting by electricity between the hours of three and five o'clock in the afternoons of each day of the week from Monday to Friday inclusive, commencing on December 15th. The order also applies to places of public entertainment. All other users are required to reduce their consumption by a third during these two hours.

Ilford.—Price Increase.—The following revised charges for lighting come into operation on and after the meter readings for the quarter ending this month:—Rate "B" (flat rate), increase from 7d. to 8d. per unit. Rate "C" (maximum demand), increase from 8d. and 5d. to 8d. and 6d. per unit. Rate "D" (slot meters), increase from 7½d. to 8d. per unit.

Lewes.—Breakdown.—Owing to a defective boiler tube and the breaking of a valve on the Diesel engine, the power station had to be shut down on December 2nd.

London.—St. Pancras.—The Chief Electrical Engineer reports that he has had great difficulty in obtaining adequate supplies of coal from the contractors, Messrs. Beattie & Co., and has been informed that this is due to the Coal Controller diverting stocks intended for the undertaking in other directions; at present he is 1,600 tons short on contract deliveries, and has had to purchase outside the contract at special prices.

Finding "very great difficulty" in maintaining an efficient supply of electricity between 4 and 6 p.m., the E.C. appeals to consumers to curtail consumption.

Electricity Supply.—A recommendation of the Finance Committee to sanction the borrowing by Hackney of £56,423, and by Hammersmith of £49,925, for the extension of local electricity undertakings, came before the L.C.C. on Tuesday. Mr. H. H. Gordon said the whole situation would be revolutionised by the changes in the Electricity Supply Bill in the House of Lords; the question of London's electricity supply would once more be in the melting-pot, and everything would be in chaos and disorder. The Council had reason to complain that when the Bill had reached its last stage the Government suddenly altered its whole underlying basis. Consideration of the applications from Hackney and Hammersmith was postponed until the next meeting of the Council.

Shoreditch.—The demands for energy have increased to such an extent that the whole of the plant is required to be in commission, and consequently there is no reserve in case of breakdown. The borough electrical engineer has submitted estimates for an additional 5,000-KW. alternator for the main station, rotary converters at two sub-stations, new mains, and the necessary switchgear, at a cost of £116,570.

Lourenco Marques.—Extensions.—In the course of a speech at the annual meeting in London, last week, of the Delagoa Bay Development Corporation, Ltd., Mr. Heyland, the chairman, said that in order to meet the increasing demand for electric power it would be necessary to increase almost immediately the plant at the power station. The visible increase in demand during the next two years was 300 to 400 H.P. The negotiations for certain modifications of the electric lighting contract had now been satisfactorily terminated, and an agreement had been signed and confirmed. The only material modifications were a reduction in the charges for energy and meter rents to private consumers, which would reduce the net revenue of the electric lighting undertaking by about £2,000 per annum. Substantial reductions had been granted in April, 1918, and it was these that had now received official recognition.

Manchester.—New Plant.—The Corporation's new turbo-alternator, capable of developing 25,000 KW., was started on Monday. It is the largest yet installed by any municipality in the United Kingdom, and brings the power of the Stuart Street plant up to 90,000 KW.

Middlesbrough.—Extensions.—The Corporation is to install at the electricity works two sets of combined 350-KW. gas-engine generators, and the tender of Messrs. Browett, Lindley and Co., at £7,946 per set, has been accepted. The gas-producer plant, it is estimated, will cost £400 for each set. The engines are to be obtained in order to meet the requirements of the transporter bridge and pumping station, and are to operate either on town or producer gas. By this means an independent supply will be available for the maintenance of essential services, including tramways, if the Tramways Committee decided to take the supply from this department. A new 1-sq. in. cable is to be ordered, at an estimated cost of £4,800.

New Zealand.—Canterbury.—The electrical department is to establish as many charging stations for electric vehicles as possible, in order to overcome the distance difficulty which prevents the use of this mode of transport by farmers.

South Island.—A deputation from a conference of progress leagues recently met the Prime Minister, and emphasis was laid on the need for hydro-electric developments.

Hamilton.—A report upon the proposed electrical extensions, involving an outlay of £50,000, has been submitted to the B.C. Some of the improvements suggested are a subsidiary power station (£17,500), street lighting (£4,000), and water works (£4,910).

Rawtenstall.—Loan.—In connection with the proposed extensions to the Corporation electricity undertaking at Hareholme, Cloughfold, application is to be made for sanction to borrow £117,000, of which about £87,000 is required for immediate purposes.

Tasmania.—Water Power.—At the annual meeting of the Mount Read and Rosebery Mines, Ltd., the chairman stated that the Tasmanian Parliament had authorised the Minister of Works to construct the Lake Rolleston power scheme at a maximum cost of £500,000, and to contract to supply this company near Zeehan with 15,000 H.P. for 15 years at 55s. per H.P. per annum on the company providing guarantees that necessary capital for treatment plant installation was available. The chairman also said that the company had purchased from the Government the works of the Tasmanian Smelting Co., at Zeehan, on favourable terms for a site for the electrolytic zinc refinery.

Tynemouth.—Year's Working.—The annual report upon the Corporation electricity works for the past year, shows a gross revenue of £27,247, against £24,613 in 1918, and £22,435 in 1917. The trading expenses absorbed £20,020, and the balance for transfer to the net revenue account was £7,227, equivalent to 26·53 per cent. of the gross income, and representing a trading return of 7·33 per cent. on the capital employed.

Walsall.—Housing Scheme.—The E.C. proposes subject to an arrangement with the Housing Committee to light with electric light the houses proposed to be erected at Blakenhall, the necessary extension of mains be carried out at a total estimated cost of £700. The purchase of three canal boats for the Committee, for the sum of £885, is also recommended.

Walton-on-Naze.—Time Extension.—With reference to the recent B. of T. inquiry into the condition of the plant at the E.L. works, the company has been given until January 1st to put the undertaking in order.

Willesden.—Year's Working.—The report for the year ended March 31st, 1919, shows an income of £57,509, with a corresponding expenditure of £59,117, or a loss of £1,608. The number of units purchased from the North Metropolitan P.S. Co. was 7,684,707, which was 170,950 less than the previous year. Two sub-stations were fitted with 500-KW. rotary converters during the year.

United States.—Fuel Shortage.—The strike of U.S.A. household coal miners, which began on November 1st, has been settled. The restrictions placed upon lighting, heating, and power, as announced in our last issue will, however, continue in force for some time to come.

Yeovil.—Time Extension.—The B. of T. has extended the time of the Yeovil Electric Lighting Order, 1914, until April, 1920.

TRAMWAY AND RAILWAY NOTES.

Belfast.—Supply Failure.—During the busiest part of the afternoon of December 8th, the tramway service was brought to a standstill, owing to the failure of the supply. It is reported that the stoppage was due to the insufficiency of river water available for condensing purposes, as the tide was low at this time.

Burton and Ashby.—Accident.—In his report to the Ministry of Transport upon a tramway accident which occurred in October last, Major G. L. Hall, R.E., states that the brake equipment was in working order, the accident being mainly due to the bad condition of a part of the rails. The driver was partly responsible in that, when the magnetic brake failed to hold the car at first, he assumed it to be out of order, although his position was rendered difficult by attendant circumstances. The sand-releasing gear failed to act owing to the collapse of the actuating pedal. If the hand-brake was applied, it was not sufficient to lock the wheels, which would render the magnetic brake ineffective. It was considered unnecessary to question the adequacy of the braking arrangements, but steps should be taken to alter the design of the sand-releasing apparatus. The people injured numbered 16, the conductress and one passenger subsequently succumbing.

Continental.—Switzerland. — Electrification of the Swiss railways is proceeding apace. December 11th was fixed for the opening of the Davos and the Filisur line for passenger traffic. Next year it is hoped to have finished the electrification of the line between Davos and Klosters, and in 1921 between Klosters and Landquart and between Reichenau and Disentis.

Glasgow.—Electric Vehicles.—For the non-delivery of electric vehicles both Messrs. Edison Accumulators, Ltd., and Electric Vehicles, Ltd., are to be held liable to the penalties provided in their respective contracts.

London.—L.C.C.—The average number of cars running on the Council's tramways is 1,277, and the number under repair is 383. There has been considerable delay in delivery of materials for repairs.

The new basis of fares, approved in April, has been in operation for six months. The results show that there is likely to be a considerable deficiency on working, after providing for the payment of debt charges, and that the amount now standing in the renewals and general reserve funds will not be sufficient to make up this deficiency and to meet the cost of renewals actually carried out during the year. In these circumstances, the conclusion has been come to that, unless some other remedy is forthcoming, it will be necessary to further increase the tramway fares.

Accidents.—On Thursday last week, an axle broke on a City and South London train between Stockwell and the Oval. A District train also broke down on the South Harrow line. Both accidents caused considerable delay.

Steam trains are now reported to be running on the electric "loop" line from Waterloo Station to relieve the pressure during the busy hours in the evening.

Sir Albert Stanley, in a speech last week at the Savoy Hotel, said that the traffic problem could not be solved by a dozen or more separate undertakings; there would have to be complete co-ordination. The cost made it impossible for any organisation to provide a seat at any hour of the day for every passenger. The strap-hanger had come to stay; any prospect of profit arising out carrying passengers in London to-day had disappeared. The shareholders of the Underground had received in 51 years no more than £70,000, which situation could obviously not continue. Their average rate of pay was £194 per year, and they asked from those who used the facilities to maintain the solvency of the undertakings, provide good wages for the employés, and a reasonable return for the enterprise.

Woolwich.—It is understood that the East Ham Corporation is to urge upon the Minister of Transport the desirability of constructing a high-speed tube railway on the Kearney system between Woolwich and East Ham. Woolwich Corporation supports construction by a company.

Manchester.—Fare Increase.—It has been decided to increase the 1½d. fares to 2d. Councillor Barton, President of the British Socialist Party, favoured free tramway rides, the expenses to be borne by the rates.

Newcastle-upon-Tyne.—Bill.—It has been formally decided to promote the Parliamentary Bill which seeks power for, *inter alia*, the extension of the tramway service both inside and beyond the city boundaries. The cost of the construction of the tramways and tramroads will be £393,850, and of the equipment £54,075. It is proposed to increase the contribution to the rates for road maintenance from ¼d. to 1d. per car-mile per annum. The undertakers of motor-'bus services and owners of other motor vehicles would be required to contribute 1d. per car-mile per year.

Railway Electrification.—The policies of Great Britain, France, and Belgium, were recently reviewed by Mr. A. McCallum in the *Electric Railway Journal*. In France, the subject is complicated by its forming part of a comprehensive scheme of national reconstruction. Only in Belgium does it seem likely that electrification work will very soon be commenced. The immediate future of railway electrification in Great Britain depends entirely upon the ultimate fate of the Ministry of Ways and Communications and the Electricity (Supply) Bill. Little avoidable capital outlay is likely to be made by railways during the two years for which they are bound by Government control; it is at present impossible to say what will happen after that. It is expected that the line from London to Southend (about 40 miles) will be electrified at an early date, and that the South-Eastern Railway will be electrified from London to Dover (more than 70 miles) provided that the Channel tunnel scheme goes forward as it promises to do. As for the rest, the prospect seems to be one of suburban electrification gradually carried further out from the great cities and, at least in some cases, ultimately meeting and joining up. It is thought probable that direct current will be used in most of the electrification schemes.

Sheffield.—Fare Increase.—It is proposed to increase the tramway fares from 1½d. to 2d. The fares were raised from 1d. to 1½d. last February, but the tramways manager estimates that if income is not increased there will be a loss of £36,900 at the end of this year, and that this loss will be increased to at least £72,500 by the end of next year. He estimates that the increase of fare will bring in an increased revenue of £115,908 per annum.

Tynemouth.—Accident.—In his report to the Minister of Transport, Major G. L. Hall, R.E., states that the tramway accident which occurred at Borough Road on September 27th, was due to the locking of the car wheels owing to the sudden application of the hand-brake as the vehicle was rounding a curve. Responsibility was attributed to the motor-man for approaching the stopping place where the accident occurred at too high a speed, and for unskilful manipulation of his brakes and sand gear.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—It has become necessary to make considerable alterations to the existing wireless stations; £10,000 has already been expended in this direction, and it is estimated that a further £3,000 will be required.

The Shaw Wireless Works, recently purchased by the Government, is stated by Admiral Jellicoe, in a report to the Commonwealth, to be a most suitable nucleus for war preparations, possessing ample facilities for the development of secret experimental work, and also for the manufacture of jigs, patterns and gauges necessary for the production of war material.

Automatic Telephones.—The first automatic telephone installation to be put in commission in Dublin has just been completed at Messrs. Pim Bros.', Ltd., premises, by Messrs. Maurice Pitman & Son, the equipment having been manufactured by the Automatic Telephone Co. The installation is designed to accommodate 50 lines, but of these only 24 are in commission, leaving 26 additional lines for future extension. Energy is supplied by a central battery of Chloride accumulators, comprising two sets of 25 cells each, the duplicate sets being used alternately, the one supplying energy to the equipment, while the other is on charge. There is over two miles of cable supplying the 24 telephones in operation, and it augurs well for the installation that on its maiden trial it worked perfectly without a hitch.

The Hull Corporation has applied for sanction to borrow £61,786 for telephone extensions, £3,000 being required to erect an automatic exchange. Although in 1914 a profit of £5,000 was made, last year's deficit amounted to £1,105. The Government Inspector, Col. T. C. Ekin, thought it improbable that a 25-years' loan would be sanctioned.

Iceland.—The telegraph and telephone system at the end of 1918 comprised 2,256 km. (pole route) and 6,692 km. (length of wires). There were 140 stations, 1,877 telephone instruments and 12 telegraph instruments, the telegraphic work being largely dealt with by telephone. There were 752 subscribers in Reykjavik, 139 in Akureyri, and 79 in Vestmannaeyjar.—*T. and T. Journal.*

Eastern Telegraph Co.—In a letter to the President of the Manchester Chamber of Commerce, in reply to complaints of cable delays, the Postmaster-General states that the fault in the above company's main cable has now been removed. The number of words dealt with in 1918 amounted to 180 millions, compared with 64 millions in 1913. The routes of the Great Northern and Indo-European Companies, *viâ* Russia and Germany, are still interrupted. A new cable is now being laid between this country and Gibraltar, and orders have been given for cable to provide a new high-speed line to the East by way of the Mediterranean, Red Sea, and *viâ* Bombay and Madras to Singapore.

France.—An official notice issued in Paris says that on and after December 16th a surtax of 53 centimes per franc was added to the cost of foreign telegrams, including wireless telegrams.

It is officially announced that the telegraph service between France and Germany will be resumed on December 17th. The resumption has been delayed owing to the difficulty of establishing permanent lines through the devastated regions. The charge will be 18 centimes per word and no code messages will be allowed. Telegrams in French, German, English, Italian, and Japanese, will be received for transmission.

Storm Damage.—It was reported last week that violent storms in the Alps had caused an interruption in telegraphic and telephonic communication between Italy and France and England.

Teneriffe.—Tenders have lately been invited for the establishment of a telephone service on the Island of Teneriffe.

Tonga.—At the present time the Tongan group of islands have no rapid means of communicating with the outside world. An order has been placed with Amalgamated Wireless (Australasia), Ltd., for a complete wireless equipment to provide direct communication between Nukualofa and Suva. The entire apparatus, which includes valve receivers, power plant, storage batteries, and specially designed masts, will be manufactured by the company at its works in Sydney, and erected by Australian engineers.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Sydney. — January 28th, 1920. N.S.W. Government Railways and Tramways. One 1,250-kw., 50-cycle turbo-alternator.

February 18th, 1920. One electrically-controlled tower clock and four dials, for Sydney sub-station. Chief Electrical Engineer's Office, 61, Hunter Street, Sydney.

Perth, W.A.—February 10th, 1920. P.M.G.'s Department. 340 accumulators (schedule W.A.647.) (See this issue.)

Barnes.—January 20th, 1920. U.D.C. Electricity Department. Supply of water-tube boilers, economisers, draught plant, turbo-alternators, condensers, air and circulating pumps, transformers and rotary converters. (December 12th.)

Bedwellty.—December 29th. U.D.C. Supply and erection of a small sub-station equipment, and about 3,000 yd. of pole line. (See this issue.)

Belfast. — December 22nd. Electricity Department. Steam, water and other pipework for the New Harbour power station. (November 28th.)

Chile.—March 15th, 1920. Comision de Puertos, Santiago. Electrical machinery (power and lighting) for the Port of Valparaiso. Comision de Puertos, Santiago, Chile. Copies of the specifications can be seen at the Chilean Legation, London, between 3 and 5 p.m.

Dundee.—January 23rd, 1920. Corporation. Electricity Department. Three 750-kw. converter sets; one 300-kw. ditto; 11,000 v., E.H.T. switchboard; two 750-kw., D.C. control panels; one 300-kw. ditto. (See this issue.)

Govan (Glasgow).—December 30th. Clyde Navigation Trustees. Electrically-driven de-watering pumps for Nos. 1, 2 and 3 Graving Docks, Govan. W. Bridges & Co., Engineers, 3, Salters Hall Court, London, E.C. 4.

Halifax.—January 5th. Electricity Department. Supply of stores (including lighting fittings and electrical accessories, cables, meters, &c.), from February 1st, 1920, to March 31st, 1921. (See this issue.)

London.—Islington.—January 28th. Electricity Committee. Stores, including cables, meters, electric lamps, &c., for 12 months. (See this issue.)

Fulham.—January 13th, 1920. Electricity Committee. Manufacture, delivery and laying, complete, duct, E.H.T. cable, &c., between the generating stations of Fulham and Hammersmith. (See this issue.)

Stepney.—January 22nd, 1920. Electricity Supply Committee. Two water-tube boilers, chimneys, economisers, &c., and one 5,000-kw. turbo-alternator, with condenser, accessories and switchgear. (See this issue.)

Rhondda.—January 5th, 1920. U.D.C. Electricity Committee. Steel or wood poles and the completion of overhead lines. (See this issue.)

Sheffield.—January 2nd, 1920. Electric Supply Department. Supply and laying of six-core, E.H.T., split-conductor cable (contract No. 268). (December 12th.)

Spain. — January 25th, 1920. The Harbour Works Authorities at Alicante are inviting tenders for the supply of three electric cranes. Particulars may be obtained from, and tenders are to be sent to, the Junta de Obras del Puerto, Alicante.

Tynemouth.—January 12th, 1920. Electricity Department. Ten 250-K.V.A. transformers. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

2,000 protectors, £983.—British General Electric Co., Ltd.
500 telephones, £1,856; 150 do., £557.—Automatic Telephones (Aust.), Ltd.
800 telephones, £2,580.—Western Electric Co. (Aust.), Ltd.

P.M.G.'s Department, Victoria :—
1,300 telephones, £4,826.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, West Australia :—
100 telephones, £371.—Automatic Telephones (Aust.), Ltd.; 50 do., £161.—Western Electric Co. (Aust.), Ltd.

P.M.G.'s Department, Queensland :—
1,100 protectors, £513.—British General Electric Co., Ltd.
550 telephones, £1,774.—Western Electric Co. (Aust.), Ltd.
—*Tenders.*

Birstall.—Electricians' work in connection with the new Princess Picture Palace for Pictures (Birstall), Ltd. Messrs. H. Hainsworth, Ltd.

Heywood.—T.C. :—

Extra-high-tension and low-tension cables.—Macintosh Cable Co., Ltd.
Motor converter.—Bruce Peebles & Co.

London.—L.C.C. Fire Brigade Committee. Recommended :—

Two chassis for turntable ladders, £3,088.—Tilling-Stevens, Ltd.

L.C.C. Highways Committee. Recommended. Overhead electrical equipment for the Lee Green to Eltham tramways, &c. :—

Clough, Smith & Co., Ltd. ..	(recom.) ..	**£8,650**
B.I. & Helsby Cables, Ltd. ..	.. ..	9,889
J. G. White & Co., Ltd. ..	.. ..	11,223

Low-tension electric cables for the Lee Green to Eltham tramways, &c. :—

Western Electric Co., Ltd. ..	(recom.) ..	**£23,803**
B.I. & Helsby Cables, Ltd. ..	.. .. ..	24,227
W. T. Henley's Teleg. Works, Ltd.	.. .. ..	25,430
Siemens Bros. & Co., Ltd. ..	.. .. ..	24,752
Johnson & Phillips, Ltd. ..	.. .. ..	24,985
W. T. Glover & Co., Ltd. ..	.. .. ..	25,302
Union Cable Co., Ltd. ..	.. .. ..	25,420
Callender's Cable & Con. Co., Ltd.	.. .. ..	25,594

Shoreditch.—Electricity Committee. Recommended :—

One 1,000-kw. rotary converter, £4,930 (delivery in 15 weeks).—Metropolitan-Vickers Electrical Co., Ltd.
One 1,500-kw. motor converter, £7,039 (delivery in 35 weeks).—Bruce Peebles and Co., Ltd.

The prices do not include switchgear. Tenders were received from five contractors and included 20 different prices.

Weymouth.—T.C. :—

Repairs to boiler at the electricity works.—Cozens & Co., £408.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 19th. At Storey's Gate, S.W. Paper on "The Cutting Power of Lathe Turning Tools," by Mr. G. W. Burley.

Junior Institution of Engineers.—Friday, December 19th. At the Royal United Service Institution, Whitehall, S.W. At 7.30 p.m. Presidential address on "The Influence of the War on Engineering," by Sir E. H. Tennyson D'Eyncourt.

Saturday, December 20th. At 2.45 p.m. Visit to the L.C.C. Abbey Mills pumping station at Stratford, E.

Society of Technical Engineers.—Friday, December 19th. At the Memorial Hall, Manchester. At 7.30 p.m. Address on "The Value and Purpose of Organisation," by Mr. E. Murray Wr.ng.

NOTES.

The Electricity Supply Bill.—In the House of Lords on Tuesday, the Lord Chancellor submitted a number of amendments which removed almost the whole of the controversial elements of the Bill. He said that they would cut out the compulsory powers for the establishment of District Electricity Boards, and for the purchase of generating stations and transmission lines, and all the financial clauses except that which provided for the erection of emergency power stations up to an outlay of 20 millions sterling. The Electricity Commissioners would exercise the present powers and duties of the Board of Trade under the Electric Lighting Acts, would have power to conduct experiments, and to set up Advisory Committees. The Government held that the jettisoned parts of the Bill were greatly needed, and would reintroduce them early in the next session. The Treasury had not objected to the expenditure involved. The amendments were agreed to *en bloc*.

Alcohol from Coke.—It was stated at a meeting of Cleveland engineers on Monday night after long and patient research and many experiments Mr. Ernest Bury, a local engineer, had succeeded at Skinningrove Ironworks in extracting alcohol and its derivatives from coke-oven gas on a commercial scale. If applied to the whole of the coal carbonised in Britain, the process was estimated to yield 50,000,000 gallons of motor spirit a year, and would revolutionise the position of the country in regard to the supply of liquid fuel.—*Daily Telegraph.*

Scientific and Industrial Research.—On December 12th, Mr. A. J. Balfour presided over a conference of representatives of research organisations connected with the Department of Scientific and Industrial Research at the Institution of Civil Engineers. In the course of an inspiring address, he laid stress on the fundamental necessity of research in pure science, which he regarded as the main engine of human progress. Papers were read by Major H. W. Bliss and Mr. W. L. Balls on subjects connected with research in relation to the textile industries.

The Metric System.—The metric system formed the subject of a discussion at a meeting of the Yorkshire Branch of the Association of Mining Electrical Engineers, at Doncaster, on December 6th. Mr. Jarvis's paper, as presented to the West of Scotland Branch, was read, and a resolution approving of the institution of the system was passed.

According to the *Manchester Guardian*, at a meeting on December 9th, promoted by the Manchester and District Decimal Association, Mr. E. C. Barton gave a lecture advocating the adoption in this country of a decimal coinage and the metric system of weights and measures. He denied that the metric system would render useless machinery made on the present measures; no such result, he said, had ensued in any other country, only the actual operations of buying and selling being affected.

Mr. H. Allcock said the Manchester Decimal Association believed the metric question was now beyond academic discussion, and had become a question of real economic importance. Sooner or later the metric system must be adopted by this country.

Electric Supply Whitley Council.—The first meeting of the Whitley District Council for the electricity supply industry for the West Midlands area, comprising counties of Shropshire, Stafford, Warwick, and Worcester, was held at Birmingham, last week, the Lord Mayor presiding. Mr. R. A. Chattock, city electrical engineer, was elected chairman, and Alderman Gregory, vice-chairman. Mr. E. J. Jennings, secretary of the electricity supply department, was appointed secretary and treasurer to the Council. A draft constitution was approved and other business dealt with.

Universal Radio-Syndicate v. Baxendale.—Pending litigation in respect of a wireless telegraphic installation was mentioned in an application made before Mr. Justice Roche, in the King's Bench Division, on Tuesday. Mr. R. Goddard, referring to the above non-jury action in the list, said an action relating to a wireless telegraphic installation on the Eiffel Tower, brought by the same plaintiffs against Elwood, was tried by his Lordship early that term. The parties in this second case considered it desirable that the action, which raised practically the same issues, should be tried before his Lordship, and he (counsel) was instructed to apply for his Lordship's consent to take the case next sittings.

His Lordship gave a conditional undertaking to take the case, subject to the arrangement of the list.

Inquiries.—A correspondent who intends to open a business for himself in or near London, dealing with electrical accessories of all kinds, and domestic appliances in particular, asks for practical hints, information as to trade discounts allowed to retailers, the probable capital required to start a small concern, the general state of the market, and so on; makers of the "Carlton" projection arc lamp, Patent No. 5,199/13, and of the "Hanco" flame-proof mining bells are asked for.

Electrically-Propelled Ships.—It is reported that electricity is to displace steam power in the wooden ships constructed by the U.S. Shipping Board during the war. This conversion is expected to result in increased cargo space. The plan is to remove the existing reciprocating engines and other steam equipment, and substitute Diesel-electric engines which will drive a propeller motor directly inside the stern. It is estimated that the additional cargo space that will be gained will amount to 500 tons, besides the advantage of electric equipment and electrically-driven deck auxiliaries.

Educational.—Miss Nott, of the Metropolitan-Vickers Electrical Co., Manchester, has attained the unique position, for her sex, of Associate of the Manchester College of Technology, after passing the fifth-year course in electrical engineering.

The Metric System in U.S.A.—As the result of a campaign organised by the World Trade Club, of San Francisco, over 58,000 petitions were addressed to the U.S. Department of Commerce for or against the adoption of the metric system. Of these, 99·27 per cent. were in favour, and only 0·73 per cent. in opposition. The signatories were drawn from all branches of society, industry, and commerce.

Appointments Vacant.—Charge engineer (£305) for the Swansea Corporation electricity department; electrician for the Regent Street Polytechnic; charge engineer (£110 + 20 per cent. + £90) for the Portsmouth Corporation electricity supply department; draughtsman (£5) and overhead wiremen for the Plymouth Corporation tramways; switchboard attendant (25s. + 33s. 6d. + 12½ per cent.) for the Southampton Corporation electricity works; jointer for the Edinburgh Corporation electricity supply department; meter-room superintendent (£277) for the Sunderland Corporation electricity department. See our advertisement pages to-day.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At a meeting of the North-Eastern Centre, on November 24th, Mr. W. D. Owen delivered a lecture upon "Wireless Telegraphy in the Mercantile Marine."

After outlining the history of the subject, the lecturer proceeded to describe in great detail a marine wireless installation, and said the Marconi ship sets of to-day were substantially the same as they were 10 years ago. The discharger was now of the rotary type, and a crystal receiver was used in place of the multiple-tuner and magnetic detector. The progress that had been made during the past few years in the technical aspect of wireless telegraphy was revolutionary. The wireless operator of to-morrow would participate in the navigation of the vessel by means of the radio-goniometer, or position-finder, and the wireless telephone as an auxiliary would enable the principals to conduct their own correspondence when once communication had been established. The marine wireless telegraph of the future would be more complex than that of to-day. It would involve greater skill and experience on the part of the operator, but it would enable the small minority of skilled operators who had kept themselves abreast of technical developments to rise to heights not at present attainable.

Faraday Society.—On Monday last, a paper on "Electrolytic Iron Deposition" was read by Lieut. W. A. MacFadyen, M.C., B.A.

The work described was undertaken with a view to obtaining data on which an industrial process could be built up, for the purpose of salving worn steel parts by electro-plating them with iron. An aqueous solution of ferrous ammonium sulphate was the electrolyte used, and it was found that whilst excellent results could be obtained from dilute solutions at the normal room temperature, deposition could only be carried out very slowly; with a concentrated solution, however, equally good results were obtained at about seven times the rate usable in the former case. Varying acidity of the solution proved to have a great effect on the deposits, and the best results were given by an electrolyte made about ·005 normal with respect to sulphuric acid.

By heating the bath to a temperature of 60° C., deposition from a concentrated solution could be carried out satisfactorily at a rate of up to 50 times that which was possible in the case of the dilute cold solution. Iron can be deposited direct on steel, and subsequent heat treatment produces an adhesion of the deposit to the basis metal very much better than the best attainable by simple plating, and the deposited iron is much tougher than before treating, although it is considerably softer. Such deposits can also be case-hardened with good effect.

Electricity Supply Commercial Association.—The annual general meeting of the West of England Divisional Branch Council was held at Bristol on December 12th. Mr. T. H. Gait (Bristol), divisional branch chairman, presided, and the members present included representatives from Bath, Bristol, Gloucester, and Cornwall. The hon. secretary, Mr. A. N. Allen (Gloucester) presented an excellent report of the work accomplished, and the hon. treasurer, Mr. E. E. MacVitie (Bristol), presented the statement of accounts.

Society of Technical Engineers.—The first general meeting of the present session of the Bristol and West of England Branch was held at Bristol on December 12th. Mr. F. J. Mallett presided, and an address on the "Aims and Objects" of the society was given by Mr. A. Davis (Morgan Crucible Co.), followed by a discussion. The next meeting was fixed for January 16th.

Birmingham and District Electric Club.—The fifteenth annual meeting of this club was held at the Grand Hotel, last Saturday evening, when the report and balance-sheet were received. The Secretary, Mr. N. Deykin, reported that in practically all directions the past year, under the presidency of Mr. W. H. Vernon, had been the most successful the club had known; the membership was now well over 100. New officers for the ensuing year were elected, the new president being Mr. H. W. Wolton, A.M.I.E.E., A.M.I.M.E. For the sixth successive year, Mr. Norman Deykin was elected honorary secretary. Mr. R. A. Chattock, city electrical engineer, who had been a member for many years, for the first time allowed himself to be proposed as a member of the Committee, and headed the poll. Under the new president, with a strengthened Committee, the new session promises to be still more successful. Visitors to Birmingham, in the electrical profession or industry, are always welcome at the club meetings, which are held at the Grand Hotel on the second Saturday in each of the winter months.

Association of Engineering and Shipbuilding Draughtsmen.—Courses of lectures covering a very wide field are being given at the Association's various Centres. Practically every branch of engineering is dealt with, but the lectures are not confined to engineering alone. Astronomy, biology, and anthropology also receive attention, and even literature is not neglected, there being at least two literary discourses on Dickens and Shelley.

At the first of a series of lectures arranged by the Chesterfield Branch of the Association, on December 4th, a paper on "Motor-Driven Machinery" was read by Mr. W. A. Toppin, A.M.I.E.E., assistant manager of the Corporation electricity works. The application of a direct motor drive was admirably illustrated by lantern slides.

Mine Signalling.—At a meeting of the Midland branch of the Association of Mining Electrical Engineers, held at Mansfield on December 13th, Mr. A. Lees, of Kufford Colliery, in a paper on "Alternating-Current Haulage Signals," emphasised the importance of providing a reliable system of electric signalling on haulage roads to reduce the time lost, and to ensure a better output of coal.

Pulverised Fuel.—Addressing the members of the Staffordshire Iron and Steel Institute at Dudley on December 13th, Mr. L. C. Harvey, of London, speaking on the commercial value of pulverised fuel, said that if applied to electricity stations, there would be a saving of at least 25 per cent. in fuel consumption, and super-power stations, if they did materialise, would be known as the super-white elephants of a profligate age, unless the economy following the use of this fuel was practised. This kind of fuel, he said, was now receiving a fresh lease of life. Its application was going to enter very forcibly into the question of industrial transport and manufacturing processes. Light fuel deposits not now considered of much industrial value could be burned. Pulverised fuel not only reduced fuel consumption, but its use in every operation of iron and steel making would prevent or reduce oxidation.

At Swansea, last week, Mr. J. W. Burr, borough electrical engineer, lectured to a large audience on "Science in the War," dealing in an interesting way with the methods by which the Hun was beaten.

The Glasgow Exhibitions.—At the recent British Science and Key Industries Exhibition, held at Glasgow, the comprehensive exhibits illustrating the manufactures of Messrs. Siemens Bros. & Co., Ltd., were similar to those shown at the Shipping Exhibition at Olympia, an account of which was included in our notes on that show. Additional items were an automatic 30- to 50-line telephone exchange and switchboard, shown in actual working, and similar to the systems installed at Grimsby and Stockport. Other items were two forms of pyrometer and indicators for use with them, the Hopkinson-Thring torsion meter, "Twist" type of shot-firing machine, and an emergency petrol-electric generating set.

Carron Company's Stand.

At the Health and Housing Exhibition manufacturers of domestic electrical apparatus were well represented. Perhaps one of the most attractive stands was that of Carron Co., whose exhibit, which included examples of up-to-date cooking plant together with a number of tastefully designed fireplace suites and fires (some of which were in action), appealed specially to architects and others interested in better-class housing schemes.

Training Disabled Men.—A report by Mr. W. Ellerd Styles has been received covering the work of the London and Home Counties, Local Technical Advisory Committee (Electricity, Power and Light), of which he is the chairman, for the six months from June to November inclusive.

The committee, which consists of equal numbers of employers' and workers' representatives, held its first meeting on June 10th, and up to November 18th 15 meetings had been held. The number of candidates interviewed during the period covered by the report was 286, and a further 46 failed to attend when instructed. Of the total interviewed, 181 have been placed for training, and only five were found ineligible. The greater part of the remainder have had to be referred to other L.T.A.C.'s, and in some cases action has been delayed and the men instructed to apply again at a later date. The report states that long waiting lists have to be dealt with, and points out that the committee is doing its utmost to prevent the placing of men who are absolutely incapable of taking up training, on the waiting list of applicants. This unsuitability is chiefly due to the nature of the men's disablement. The loss of an arm renders the candidate totally unsuitable for training, as it must always be borne in mind that he would eventually have to compete on level terms with fit men, and consequently would be severely handicapped.

The foremost difficulty met with by the committee was the limited nature of accommodation and facilities for placing the men in order to give them the best possible opportunities of learning their trade. An instructional factory capable of accommodating 400 has been found at Hackney, a syllabus of instruction has been drawn up and approved by the Government experts, and it is hoped that Treasury sanction for the purchase of equipment will be received in time to make a start before the end of the year. Temporary facilities have been afforded by technical schools pending the opening of the instructional factory. The National Technical Advisory Committee is urged to pay great attention to the state of the industries involved in the training scheme, as it would be extremely unfair to the men to turn them out upon the labour market without a good prospect of employment, owing to the inability of their branch of industry to absorb them. As a consequence of setting up two groups of committees it is considered that a great deal of overlapping will result, and the committee urges that this dual control be eliminated in the interests of the men themselves. The support given to the scheme by the E.T.U. representatives is highly praised; they have worked whole-heartedly for the cause of the disabled men, and the chairman wishes to give this fact due prominence, as it disproves the generally accepted idea that the attitude of the trade unions towards the employment of these men is antagonistic. An appeal is made to employers to give the men every assistance and opportunity when their training is finished. Everything is being done to ensure efficiency and thoroughness, and it is hoped that those who were incapacitated for their own trades in the country's service will be enabled to settle down again in an industrious and comfortable citizenship. For the information of prospective employers the report gives, in conclusion, details of rates of payment. Except in special cases the course of training commences with six months at a technical school and extends over a period of three years, at the end of which the men are to be accepted as skilled workmen at the full rate payable in their particular trades.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Stoke Newington Electric Supply Committee has appointed Councillor G. King chairman, and Councillor T. H. Hanson vice-chairman, for the ensuing year.

Barnsley T.C. has made the following promotions on the staff at the electricity works: Mr. J. Wetherell to be chief assistant, at a salary of £325 a year; Mr. C. Pickering, commercial assistant, £300; Mr. E. Andrews, station superintendent, £270; and Mr. J. A. T. Carr, mains superintendent, £270.

Hackney B.C. Establishment and General Purposes Committee recommends that £30 be paid to Mr. E. Mathews, testing engineer in the electricity department, in respect of the extra services rendered by him in connection with the Household Fuel and Lighting Order.

The salary of Mr. A. B. Slater, manager of the borough tramways at Burton-upon-Trent, has been increased by £125 per annum (less war bonus), with an additional £50 twelve months hence.

General.—The Mayor of Swansea (Alderman A. Sinclair) has been re-elected chairman of the Corporation Electricity Committee, and Councillor G. Colwill has been appointed vice-chairman.

Lieutenant J. Lawther, Tyne Electrical Engineers, has relinquished the acting rank of captain on ceasing to be employed.

Mr. W. Walker, C.B.E., has been appointed Chief Inspector of Mines in place of Sir Richard Redmayne, K.C.B., who is now chairman of the Imperial Mineral Resources Bureau. Mr. Walker has been acting as Chief Inspector of Mines for the past three years.

Dr. Cecil H. Desch, of the Royal Technical College, Glasgow, has been appointed Professor of Metallurgy at Sheffield University in succession to Dr. Arnold, who recently resigned and has been elected Emeritus Professor

Mr. W. G. Crawford, of the Clyde Valley Electrical Power Co., Glasgow, has been appointed Scottish representative for the Electrical Apparatus Co., Ltd., Vauxhall Works, London, Mr. J. Ferguson having resigned his position to take up an important appointment in India. The Electrical Apparatus Co.'s Glasgow offices are 74, York Street.

Mr. E. Jacob has resigned his post of managing director of the Tudor Accumulator Co., Ltd., of which he was one of the founders 25 years ago; he retains the business of the Rail Welding Co., which he acquired from the Tudor Accumulator Co. last year, and his address will be 119, Victoria Street, S.W.1.

Mr. H. Tabossi, M.Amer.I.E.E., A.M.I.E.E., commercial engineer with the British Thomson-Houston Co., Ltd., Rugby, is leaving on January 16th per s.s. *Andes* for a six months' trip to the Argentine Republic. Mr. Tabossi, who is an Argentine citizen, received his technical training in the U.S.A., being a Master of Sciences of Havard University, and a Bachelor of Sciences of the Ohio State University. Previous to joining the staff of the B.T.H. Co., four years ago, he was in the employ of Messrs. J. G. White & Co., London, as an assistant engineer.

The Council of the University of Birmingham has elected Mr. William Cramp, D.Sc., M.Sc.Tech., M.I.E.E., to fill the chair of Electrical Engineering recently vacated by Dr. Kapp. Dr. Cramp was for some years on the staff of Messrs. Ferranti, Ltd., Hollinwood, and on leaving that firm he became lecturer and demonstrator under the late Prof. Ayrton at the Central Technical College, London. Later he held a similar appointment at the Manchester College of Technology, but has for many years now carried on a successful consulting practice, latterly in partnership with Mr. Julius Frith, in Manchester. He is a past chairman and an active member of the North-Western Territorial Centre of the Institution of Electrical Engineers, and one of the original promoters of the Engineers' Club, Manchester. He is the author of books on Electrical Design and Alternating Current Calculations, and has carried out researches in electrical and electro-chemical work. His many friends will join us in congratulations on his appointment to the important post at Birmingham.

Obituary.—MR. S. WARREN.—According to the *Industrial Australian and Mining Standard*, the death occurred recently of Mr. S. Warren, late manager of Messrs. Siemens Bros. Dynamo Works, Ltd., Sydney branch, from heart failure. The late gentleman joined the firm of Messrs. Siemens Bros. about 30 years ago, his first duty being to superintend the Launceston (Tas.) electric lighting, under the direction of Mr. Lee Murray. In conjunction with Mr. Lee Murray he opened the Sydney branch of Messrs. Siemens Bros., with which he had been associated for the past 22 years.

MR. J. CONNER.—The death took place, on Friday last, of Mr. W. G. Conner, eldest son of Mr. J. Conner, O.B.E., manager of Messrs. Dick, Kerr & Co.'s works, Preston. Deceased was 33 years of age. At the outbreak of war he was in Spain on work connected with Spanish ores. On his return he was anxious to join up, but the directors, realising the necessity of getting tools and machines for the making of munitions, insisted on him undertaking a journey to America for this purpose. After the armistice he was sent on a business tour through America and Japan, and on his return was appointed to a responsible position at the works.

NEW COMPANIES REGISTERED.

North Staffordshire Electro-Therapeutic and Massage Co., Ltd. (161,560).—Private company. Registered December 11th. Capital, £2,000 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: G. H. List, M.D., Cliffe Bank Lodge, Stoke-on-Trent; E. B. Reynish, Portland, Hartshill Road, Stoke-on-Trent, agent; J. T. Sandland, Victoria Chambers, Stoke-on-Trent, incorporated accountant. The first directors are: G. H. List, M.D., E. B. Reynish, and J. T. Sandland. Qualification, £100. Solicitor: R. A. Llewellyn, Church Street, Stoke-on-Trent.

American Car and Foundry Co., Ltd. (161,510).—Private company. Registered December 11th. Capital, £20,000 in £1 shares. To carry on the business of dealers in and agents for the purchase and sale of locomotives, carriages, wagons and rolling stock of all kinds for use on railways or tramways, or for road, field or other traffic, &c. The subscribers (each with one share) are: C. S. Gawthrop, 246, West End Avenue, New York City, U.S.A., engineer; E. H. Pearson, The Downs, Ashstead, Surrey, director of a public company. The first directors are: C. S. Gawthrop and E. H. Pearson. Registered office: Georgian House, Bury Street, St. James, S.W.

Charters Electric Supplies Co., Ltd. (161,326).—Private company. Registered December 5th. Capital, £1,000 in £1 shares. Objects: To take over the business of an electrical engineer, and dealers in electric supplies carried on by C. H. Charters at 1, Mill Street, Warrington, as the "Electric Supplies Co." The subscribers (each with one share) are: C. H. Charters, Mount Pleasant, Haslington, near Crewe, electrical engineer; P. Peacock, jun., 44, Hood Lane, Sankey, Warrington, tailor. The first directors are: C. H. Charters (managing director) and P. Peacock (both permanent). Qualification, £50. Registered office: 1, Mill Street, Warrington.

Casswell, Ltd. (161,521).—Private company. Registered December 11th. Capital, £2,000 in £1 shares. Objects: To purchase the complete patent rights of L. H. Casswell in provisional protection No. 2,038 of 1919, relating to lamp shade holders used in connection with electric, oil and gas lamps (especially electric), &c. The subscribers are: L. H. Casswell, 47, Tonbridge Road, Maidstone, electrical engineer, 300 shares; H. Casswell, 47, Tonbridge Road, Maidstone, manager of factory, 50 shares; E. E. Randell, 171, High Street, Chatham, surveyor, 350 shares. The first directors are: J. H. Casswell and E. E. Randall (both permanent, subject to each holding 300 shares). Registered office: Church Street, Maidstone, Kent.

Abell & Smith's Electrical Co., Ltd. (161,459).—Private company. Registered December 10th. Capital, £10,000 in £1 shares. To carry on the business of electrical and mechanical engineers, patentees, &c. Agreement with C. E. Abell. The subscribers (each with one share) are: C. E. Abell, 1, Ronkswood, Worcester, engineer; R. H. Abell, 1, Ronkswood, Worcester, solicitor. C. E. Abell is the first director. Qualification, £100. Secretary, C. E. Abell. Registered office: 19, The Foregate, Worcester.

Arrota Electrical and Motor Accessories Co., Ltd. (161,410).—Private company. Registered December 9th. Capital, £50,000 in 10,000 6 per cent. cumulative income tax free preference and 39,400 ordinary shares of £1 each and 12,000 deferred shares of 1s. each. Objects: To acquire from E. Nickerson, A. E. Moffat, E. Nickerson, and H. Fryman the benefit of certain existing inventions relating to signalling apparatus for road vehicles, &c. The subscribers (each with 2,000 ordinary shares) are: E. Nickerson, Royal Dock Chambers, Great Grimsby, chemical exporter; A. E. Moffat, Royal Dock Chambers, Great Grimsby, shipbroker, &c. The permanent directors are: E. W. Nickerson, A. E. Moffat, E. Nickerson and H. Fryman. Qualification, £2,000. Secretary: E. Nickerson. Registered office: Charles Street, Louth.

Southern Electric Co., Ltd. (161,501).—Private company. Registered December 10th. Capital, £20,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers and contractors and manufacturers of and dealers in transformers, radiators, dynamos, &c. The subscribers (each with one share) are: H. W. Humphries, 8, Woodcote Valley Road, Purley, C.A.; W. L. Sibley, Birklands, Hale Grove Gardens, Mill Hill, N.W., accountant. Directors: H. W. Humphries and others to be appointed by the company. Registered office: 23, King Street, E.C.

Cardiff Electric and Oxy-Acetylene Welding Co., Ltd. (161,412).—Private company. Registered December 8th. Capital, £10,000 in £1 shares. Objects: To carry on the business indicated by the title, and that of shipbuilders, and repairers, engineers, &c. The subscribers (each with one share) are: Mrs. E. Thomas, 17, Harrissmith Road, Cardiff; D. W. Thomas, 17, Harrissmith Road, Cardiff, welder. The first directors are: D. W. Thomas and Mrs. E. Thomas (both permanent). Registered office: 51, Loudoun Square, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Torquay Tramways Co., Ltd.—Satisfaction registered October 28th, 1919, to the extent of £1,000, part of £60,000 prior lien debentures, registered March, 1911.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Mortgage on land, buildings, plant, &c., at Dunston, registered October 28th, 1919 (by permission of the court), to secure £330,000. Holder: Minister of Munitions.

CITY NOTES.

The Allgemeine Elektrizitats Gesellschaft.

The report of the directors of the Allgemeine Elektrizitats Gesellschaft for 1918-19 states that the world's demand for merchandise of all kinds was very considerable, and would assure to the company abundant work if customers regained confidence in conscientious delivery, and if this confidence was justified by stability in the efficiency of the workmen. The throwing away of goods at any prices obtainable, which robbed the country and brought it into conflict with other nations, was deserving of censure, and could only be prevented by industrial combination; and in other respects also the industry would not be able to manage without organised action in common. So far the frequent strikes had not destroyed the mutual understanding which existed between the works' managements and their fellow workers. As compared with the last peace year, the number of officials and workers diminished by 10 per cent. in 1918-19, whereas the expenses for salaries, wages, and bonuses rose from 69,242,000 marks in 1913-14 to 180,461,000 marks last year. Discussing the financial situation, the report states that as a result of the prevailing circumstances the liquid funds had decreased simultaneously with a large increase in the stocks, largely composed of semi-finished products, which did not contribute towards the turnover in goods or money. In the long run such a condition was untenable for the realisation of money on account of the disproportion to the growth in the costs of production, as it would lead to a reduction in business and in the number of workers employed. It was proposed to pave the way towards an equalisation of this state of affairs by an augmentation in the debentures, especially as a further decrease in the liquidity would take place in the first three months of the new financial year (that is to say, has taken place in the period ended with October, 1919). The report then proceeds to refer to the different departments. In the case of the machine and apparatus works, it is stated that these took an active interest in the efforts of the Standards' Committee of German Industry to bring about standardisation and syndication. The works at Oberschonweide were fully occupied; the glow lamp factory had yielded satisfactory results, and was confronted with new problems through the combination with the Osram works; the turbine works had a higher turnover than in the previous year, and sufficient orders were on hand for oil engines, whilst the locomotive factory produced engines for main line, industrial, and colliery railways. The steel works suffered from a scarcity of raw materials. Many inquiries were received for extensions and new plant at general works, and at iron works, orders for plant for lighting and transporting being specially numerous for the purpose of overcoming the difficult labour conditions by the substitution of electric power. The demand on the part of neutral countries and of "hitherto hostile countries" for the company's products showed that German industry still enjoyed its former esteem. After referring to large orders for generating station plant, including an extension for the city of Amsterdam, the report states that the work in connection with electric railway working was resumed, whilst orders for steam locomotives were received from the Prussian State railways. The accounts for a period of three years may be summarised as follows:—

	1914—15. Marks.	1917—18. Marks.	1918—19. Marks.
Ordinary share capital ...	155,000,000	200,000,000	200,000,000
Brought forward	727,000	1,180,000	1,041,000
Gross profits...	30,884,000	62,330,000	38,306,000
War allowances	4,612,000	15,290,000	—
Depreciation	895,000	3,413,000	1,185,000
Net profits and balance forward	21,298,000	37,200,000	27,031,000
Bonuses	1 500,000	2,500,000	3,000,000
Pension fund	1,500,000	3,000,000	2,500,000
War benevolent fund ...	—	1,500,000	—
Dividend	17,050,000	28,000,000	20,000,000
„ per cent.	11	14	10
Carried forward	705,000	1,041,000	1,031,000

The report further mentions that the company's credit at the banks on July 31st, 1919, amounted to 139,680,000 marks, as compared with 152,700,000 marks on the corresponding date in 1918. It is also stated that at the end of the financial year raw materials represented a value of 68,550,000 marks, semi-finished materials 63,310,000 marks, and finished products 39,840,000 marks, whilst installations in hand were entered at 24,300,000 marks.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following securities under Temporary Regulation 4 (3):—

London Electric Wire Co. & Smiths.—350,000 7½ per cent. cumulative preference shares of £1 each, 10s. paid, Nos. 50,001 to 400,000, after issue of allotment letters.

Power Gas Corporation, Ltd.—Dividend of 6 per cent. per annum, less tax. £6,700 to reserve. £26,309 carried forward.

Compagnie Francaise des Cables Telegraphiques.—The report of the directors of this company, which deals with the year 1918, states that the working expenses increased by 1,000,000 francs as a result of the higher wages paid and the greater cost of raw materials, and these augmentations continued in the new financial year. On the other hand, cable interruptions had not, and no doubt would not, have in the future the same consequences as those which occurred in 1918, when the state of war prevented any repairs being carried out for some months. Concerning the Compagnie Générale de Telegraphie sans Fil, which was formed in January, 1918, and in which the cable company is interested, the report states that the wireless company realised profits in its first year of activity, and its future prospects appeared very favourable. The accounts of the cable company show net profits amounting to 5,328,000 francs, as contrasted with 6,390,000 francs in 1917, and a dividend at the rate of 23.76 francs per ordinary share has been declared.

Tees Power Station Co.—The directors report to October 1st states that expenditure on capital account in respect of the power station amounted at that date to £610,732. During the year 36,000 additional fully-paid ordinary shares have been allotted to Newcastle-upon-Tyne Electric Supply Co., Ltd. Total paid-up share capital now £144,550. The *Financier* states that the erection of power station has not progressed so rapidly as anticipated, owing to delay in delivery of material and plant, but it is fully expected that a section of the plant will be ready for commercial operation towards the end of April next year. The amount received during the year from the Newcastle Co., representing 6 per cent. on the company's paid-up share capital, was £4,053. Adding £1,841 brought forward, there is available £5,894 to be carried forward.

Monte Video Telephone Co., Ltd.—Presiding at the annual meeting, last week, the chairman (Mr. C. Lock) said that during the year the net gain in the number of subscribers was 1,175, involving a substantial increase in the gross cash subscriptions. Working expenses at Monte Video were also higher by £4,810 in consequence. The net result was an increase in profit, including the abnormal gain on exchange, of £10,567. With a view to expediting the matter of permission to instal a modern underground system, Mr. W. W. Cook visited Monte Video and placed his experience at the disposal of the local board and of the Uruguayan Government. As a result a proposal embodying definite terms for a contract had been lodged with the Government, and was receiving attention.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The accounts for the year ended December, 1918, now issued, show that the revenue was £2,070,119; ordinary expenses were £406,347; maintenance of cables and other special expenditure cost £214,009; leaving a balance of £1,449,762. Income tax and excess profits duty payable in England amount to £860,611, and interest on mortgage debenture stock to £30,096. The balance is £559,055, plus £72,261 brought forward. £350,000 has been placed to general reserve. Four dividends and a bonus of 2 per cent. made the total distribution for 1918 8 per cent., free of income tax. A balance of £41,316 was carried forward. Meeting December 17th.

Western Telegraph Co., Ltd.—For the year ended June, 1919, the revenue was £1,963,780; the working expenses were £663,390. After providing £32,747 for debenture stock interest and £536,626 for income tax and excess profits duty, the balance was £731,017, plus £33,130 brought forward. £450,000 has been transferred to general reserve, £30,000 in reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued, £50,000 to the maintenance ships reserve fund, and £30,000 to the land and buildings depreciation fund. Four dividends and a bonus of 2 per cent. make a total of 8 per cent., free of income tax, for the year. £37,803 carried forward.

Manx Electric Railway Co.—For the year ended September 30th the gross receipts amount to £57,102 and gross expenditure to £25,601, profit on working being £31,501. The debit balance brought forward was £31,411, leaving £90, and, after deducting this from interest on first debentures, namely, £9,000, there remains a debit balance on revenue account of £8,910. It is proposed to resume cash payments for the half-year's interest due on April 1st next for both the first and second debentures, together with the interest on the latter which has accrued since the date of their issue.—*Financial Times.*

Prospectuses.—*London Electric Wire Co. and Smiths, Ltd.*—The issue of 350,000 7½ per cent. cumulative preference shares was largely over-subscribed.

Mann Egerton & Co., Ltd.—It is announced that the issue of preference shares was over-subscribed.

English Electric Co., Ltd.—Messrs. Higginson & Co. are prepared to receive fully-paid allotment letters of this company's 5½ per cent. debentures at their offices, 80, Lombard Street, London, E.C.3, for exchange into debentures to bearer.

Provincial Tramways Co.—During the year ended September, 1919, the net revenue received from the local companies was £55,644, against £59,054 last year. The directors have put to credit of reserve and depreciation account £10,000; and to reserve account for third party insurance, excess profits duty, or other purposes £10,000. Total dividend and bonus for the year 2s. (10 per cent.). £10,803 to be carried forward.

British Vacuum Cleaner Co., Ltd.—Dividend of 3d. per share (about 4 per cent.) for the year ended September, 1919. Carried forward £777.

Electric & General Investment Co., Ltd.—Dividend on the preference shares at 6 per cent. per annum for the six months ended December, 1919.

Edgar Allen & Co., Ltd.—Interim dividend of 1s. per share on the ordinary shares.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent. for the quarter ending December 31st.

STOCKS AND SHARES.

Tuesday Evening.

The course of Stock Exchange prices has been helped by the important meeting of the Premiers at the end of last week. The arrangements then arrived at had the effect of sending down the French exchange with a run. This has gone far to restoring confidence in the outlook for inter-bourse securities, while British Government issues advanced sharply, and a general rise in the Home Railway market pointed to the appearance once more of the "old-fashioned" investor in the Stock Exchange.

Home Railways advanced on the assumption that it will not be long before a revised scale of freights comes into operation. Moreover, the less implacable attitude of the Labour party is hailed as an indication of greater settlement in the industrial world. The strike of moulders is an unhappy fly in the ointment. Its prolongation has led to recurrence of rumours as to possible troubles early in the New Year. Rumours indeed have been put into circulation that the special constables have received notice to hold themselves in readiness for duty at Christmas-time, but if this is the case the present writer has been left out, although the district where he serves is not one of the quietest in London. The rise in Home Rails has not extended to the Undergrounds. Underground Electric income bonds, indeed, are flat at 82, due to sales from the Continent. Seeing that the coupons on these income bonds are payable in New York as well as in London, it is a little surprising that the price should have yielded so easily, and at the present level the bonds look reasonably attractive. Metropolitans at 24 are ¼ better, but Districts sagged to 20.

Foreign selling is also responsible for a drop of £3 in Great Northern Telegraphs, lowering the price to 23½, and making the return look distinctly attractive. Owing to the movements of the foreign exchanges, it pays holders resident outside the United Kingdom to take money rather than to hold stock, and a number of the adverse movements which have occurred round the Stock Exchange markets during the past few days may be traced to this cause. A few other declines in the cable group, *e.g.*, in Eastern Extensions, Globe ordinary and preference, with United River Plate Telephones, are traceable to realisations on behalf of deceased accounts. That the cable business is prospering at the present time is obvious enough to anybody who has to do with the sending or receipt of messages, for he knows full well the delays attendant upon the matter, and the explanations offered centre round the amount of traffic which the lines are now called upon to bear.

Marconis fell to 3¾ sellers, but recovered to nearly 4. The rights on the shares, after being 11s. 3d., and rising to 21s. 3d., have given way to 11s., the last reaction being due to sales by those who preferred to take their present profit rather than pay for the new shares at £3 each. Americans at 30s. are slightly lower.

Electricity supply shares are heavy, in spite of the Government Bill being shorn of such salient points as the District Boards and the powers of compulsory purchase with which the Boards were to be equipped. The Government project is therefore to take its place in the museum of other curiosities which the Coalition has collected. During the course of the various debates on the Bill, London Electricity shares have gradually dwindled in price, and amongst the latest declines are 2s. 6d. in both classes of Metropolitans, 5s. in Charing Cross preference, and 2s. 6d. in London Electric preference. Considering the handsome returns which this section now offers, it may be that the action of the House of Lords last Monday night will arouse a little interest in the shares.

Adelaide Electric preference have shed 7s. 6d. to 37s. 8d., and the new shares are also easier. Anglo-Argentine Tramways 5 per cent. debenture stock has lost 3 points at 61½. Investments all round have been affected by the issue of a 6 per cent. loan by Queensland at the low price of 98½. This threatens to set up a higher standard of yield against which older securities make an unfavourable comparison, and, although the rise in the price of the War Loan is a helpful

factor, it has not sufficient influence to counteract the heavy tendency introduced by the terms which newcomers consider it necessary to offer, in order to attract the money of the present-day capitalists.

With a gain of 9 points, British Columbia Electric deferred stock has risen over 50. Traffics are excellent, but the reason for this big run-up is the hope that the company may not have to part with the one cent. increase recently allowed, the destination of which was uncertain. The company has been reserving the money in case the Province might make a claim upon it, but an impression has got abroad that this may not be the case. Other issues are not altered. Mexicans remain flat.

The prolonged strike of moulders is held the cause of Babcock & Wilcox going back to 3. A dramatic jump to 3 7-16 ex dividend in Castner-Kellners set gossip furiously wagging. The most popular reason advanced is a yet closer association of the company with Brunner Monds. It is a rarity for a sharp cut in dividend to be followed by a rise of 10s. or more in the price of the shares upon which the reduced dividend is paid. India-Rubbers have lost the 5s. rise of last week; the report shows clearly how the substantial fall in profits came about. Telegraph Constructions are 10s. higher, and British Aluminiums at 35s. show a rise of 3s. 9d. Edisons have firmed up, and Cromptons also, but Siemens drooped to 26s., and Callenders, ordinary and preference, are easier. The rubber share market is decidedly better, thanks to improvement in the raw material. Armaments keep steady, a feature being the recovery to 31s. 6d. in the new ordinary, which were recently offered at 32s. 6d., and which fell to 30s. on the underwriters being left with 50 per cent. of their obligations in ordinary and preference.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Dec. 16, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	6⅝	—	£7 2 3
Charing Cross Ordinary	4	4	2¼	—	7 1 7
do. do. do 4½ Pref.	4½	4½	2⅝	— ¼	8 3 8
Chelsea	5	5	3	—	5 0 0
City of London	8	8	11⅛	—	6 17 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
County of London	7	7	9½	—	7 11 4
do do. 6 per cent. Pref.	6	6	9½	—	6 9 9
Kensington Ordinary	7	6	4⅜	—	6 6 4
London Electric	Nil	Nil	1½	—	—
do. do. 6 per cent. Pref.	5	6	3½	— ¼	9 4 8
Metropolitan	4	5	3	— ¼	8 6 8
do. 4½ per cent. Pref.	4½	4½	3	— ¼	7 10 0
St. James' and Pall Mall	9	10	6	—	8 6 8
South London	5	5	2⅛	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	6½	—	7 12 5
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	30½	—	6 12 8
do. Def.	1½	33/6	22	—	7 11 0
Chile Telephone	8	8	6½	—	6 3 1
Cuba Sub. Ord.	7	7	10½	—	*6 18 4
Eastern Extension	8	8	16⅛	— ¼	*4 18 7
Eastern Tel. Ord.	8	8	168½	— ¼	*4 15 0
Globe Tel. and T. Ord.	7	8	16½	— ¼	*4 19 3
do. do. Pref.	6	6	9⅞	— ¼	6 1 6
Great Northern Tel.	22	22	23½	—3	9 7 2
Indo-European	13	13	48⅛	—	6 13 4
Marconi	20	25	3⅛	—	6 7 0
Oriental Telephone Ord.	15	10	2⅛	—	4 14 1
United R. Plate Tel.	8	8	7⅞	— ¼	*5 5 0
West India and Panama	1/8	1/8	1½	—	Nil
Western Telegraph	8	8	17½	—	*4 12 9
Home Rails.					
Central London Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1½	24	+ ¼	5 4 2
do. District	Nil	Nil	20	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	5	82	—2	*6 2 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	3⅞	— ⅛	7 14 10
Anglo-Arg. Trams. First Pref.	5½	Nil	3⅝	—	—
do. do. 2nd Pref.	—	—	8	— ¼	—
do. do. 5 Deb.	5	5	61¼	—3½	8 2 8
Brazil Tractions	—	—	61½	—	—
Bombay Electric Pref.	6	6	13⅜	—	4 9 0
British Columbia Elec. Rly. Pfcd.	5	5	59⅝	—	8 8 0
do. do. Preferrred	Nil	2½	49⅝	—	5 5 3
do. do. Deferred	Nil	Nil	51½	+9	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	42½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—1	Nil
Mexican Light Common	Nil	Nil	25	—	Nil
do. Pref.	Nil	Nil	25	—	Nil
do. 1st Bonds	Nil	Nil	54½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3	— ¼	*5 0 0
British Aluminium Ord.	10	10	1⅞	+ 7/16	5 14 3
British Insulated Ord.	25	12½	2	— 1/16	6 5 0
Callenders	25	25	8½	— ¼	7 11 6
" 6½ Pref.	5	6½	4⅛	— 1/16	6 11 6
Castner Kellner	25	20	3⅛	+ 1/16	3 15 7
Crompton Ord.	7	10	22/-	+6d.	9 1 10
Edison-Swan, "A"	—	10	1⅞	+ 3/16	8 4 0
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1½	—	8 17 10
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	40/-	—6d.	*5 0 0
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	3⅝	—	6 4 2
India-Rubber	10	10	18½	— ½	*5 8 1
Met.-Vickers Pref.	—	—	2½	—	5 14 0
Siemens Ord.	—	10	26/-	—6d.	*7 13 10
Telegraph Con.	20	20	25	+ ½	*4 12 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, December 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Ins. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£95	..
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£39	..
a Copper Sulphate	"	£41	..
a Potash, Chlorate	per lb.	1/1	..
a " Perchlorate	"	1/8	..
a Shellac	per cwt.	£23	£1 10 inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£28	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	6d.	..
a " Crystals	per ton	17u/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£88 to £392	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/2⅜	¼d., inc.
c " Tubes (solid drawn)	"	1/6½	1d. to ½d. inc
c " Wire, basis	"	1/3	¼d. inc.
c Copper Tubes (solid drawn)	"	1/8½	¼d. inc.
g " Bars (best selected)	per ton	£151	£7 inc.
g " Sheet	"	£154	£7 inc.
g " Rod	"	£151	£7 inc.
d " (Electrolytic) Bars	"	£117	£8 inc.
d " " Sheets	"	£156	..
d " " Wire Rods	"	£132	£8 inc.
d " " H.C. Wire	per lb.	1/0½	¼d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/5	..
h Gutta-percha, fine	"	10/- to 11/-	..
h India-rubber, Para fine	"	2/6½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.C., qual.	"	£42	..
g Lead, English Pig	"	£40 10	10s. inc.
g Mercury	per bot.	£25	£3 10 inc.
a Mica (in original cases) small	per lb.	6d. to 4/6	..
a " " " medium	"	5/- to 10/-	..
a " " " large	"	12/6 to 25-/& up,	..
g Phosphor Bronze, plain castings	"	1/6 to 1/9	..
g " " rolled bars & rods	"	2/2 to 2/6	..
g " " rolled strip & sheet	"	2/3 to 2/9	..
d Silicium Bronze Wire	per lb.	1/0½	¼d. inc.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£315	£19 ins.
n " Wire, Nos. 1 to 16	per lb.	4/3	..
White Anti-friction Metals	per ton	£60 to £336	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Scientific Research. — The desirability of fostering scientific research, as a result of experience gained during the war, was recently urged upon various Government departments by the British Association.

There is reason to believe that measures are being taken to this end; in particular, the Association has received from the Admiralty a communication in which it is stated that the authorities there are keenly alive to the supreme importance of research in its bearing on naval requirements, and that the organisation of suitable arrangements for this purpose is now engaging their earnest attention. Rapid progress is now being made in the elaboration of a complete scheme, which will provide, on the one hand, for systematic and continuous development in research and experimental establishments controlled by the department, and on the other hand, for an effective relation between these establishments and scientific institutions throughout the country.—*The Times.*

Safety-first in Radiology.—In the obituary column of our issue dated December 5th, we announced the death of Dr. Jaugeas, a Parisian radiologist. In connection with this, Messrs. Watson & Sons (Electro-Medical), Ltd., have given us details of the accident which caused Dr. Jaugeas's death. The doctor was making a screen examination at a hospital in Paris, the equipment consisting of a small H.T. transformer working from A.C. without a rotating rectifier and with a radiator type of Coolidge tube. The X-ray room was very small, and the H.T. wires from the transformer to the tube were hanging in the form of a loop. Dr. Jaugeas had his hand upon the metal wheel of the tube stand for the purpose of adjusting the height of the tube. The stand was not earthed, and one of the hanging wires made contact with it, causing a direct short-circuit from the main, through the transformer, to the doctor, who was immediately killed.

Messrs. Watson point out that such accidents may be avoided by the observation of suitable precautions. These are detailed in their catalogue, and also in a publication entitled "Dangers in the X-ray Room," published by them, which is suitable for posting up in any room where X-ray apparatus is employed.

MAGNETIC STORMS AS AFFECTING OCEAN TELEGRAPH CABLES.

By EDWARD RAYMOND-BARKER.

Early last May a lecture on Magnetic Storms was delivered before the Institution of Electrical Engineers by that eminent authority on magnetography, Dr. Charles Chree, F.R.S., Director of Kew Observatory.*

The lecture matter consisted mainly of a masterly survey of general data, tables, and magnetograph records pertinent to comparison of magnetic storm observations at the Eskdalemuir, Kew, Falmouth, Stonyhurst College and other observatories of international importance.

This remarkable and altogether invaluable lecture (not previously distributed to the members in print) has quite recently (end of October) been printed in *Journal* No. 285 of the I.E.E.—not exactly in its entirety for, to avoid overcrowding, the Stonyhurst records (shown, with others, on the screen at the I.E.E.) have not been included.

Now that the lecture has been printed, the writer ventures to draw attention to certain points therewith connected.

As an instance of the practical utility of systematic and continuous magnetic records, Dr. Chree has cited the usefulness of resulting data as affording to mining engineers information and warning regarding, perhaps, the sudden advent of magnetic disturbance trouble sufficient, may be, temporarily to render all underground magnetic survey observations quite unreliable.

Also, the learned lecturer has shown how, as an outcome of a conference with representatives of the Institution of Mining Engineers, the Director of the Meteorological office has agreed to provide, week by week, information about the magnetic declination at Kew Observatory.

Much information regarding this matter, so interesting to mining engineers, is given by Dr. Chree with his usual exhaustive completeness. So much so that it was with something akin to professional jealousy that the present writer, when listening in rapt attention to the lecturer and to all the measures taken for the good of mining engineers, noted entire absence of reference to another class of the community for whom, indeed, magnetic storms possess an ultra urgent interest; namely, the men controlling the world's telegraphs, especially the ocean cables.

Certainly cable-men know well enough when the storm is on them, but, as will be shown later, warnings would be useful. Possibly, also, the cable-men's radio-telegraphic fellow-workers, in view of the close association between magnetic storms and Aurora Borealis displays, would not be averse to friendly warnings from the magnetic observatories.

In all probability Dr. Chree refrained from touching upon this branch of his subject owing to want of time and space, and to the very profuse variety of cable earth-current data already available.

In view of this—doubtless, under the circumstances, necessary—lack of reference to the bearing of magnetic storms as affecting ocean telegraph cables, the present writer ventured to communicate to the *Journal* I.E.E. certain illustrated notes. As, however, the authorities had decided, owing to pressure on space available, not to publish, for the present, remarks or communications connected with Dr. Chree's lecture, the present matter is now submitted by the writer to the Editors and readers of The Electrical Review.

Since the said matter was written and arranged, the great magnetic storm of the 11th and 12th of last August has happened. This electrical cataclysm, in some of its practical aspects, will receive attention later on.

First of all, however, in hearty appreciation of Dr. Chree's striking recital, and illustration by slides, of invaluable work done under his direction at Kew and at Eskdalemuir—with due recognition by him of services rendered by Stonyhurst College and other observatories—the present writer submits, with the following notes, a few extra records illustrative of some additional technical points not unworthy of mention.

Any discussion of magnetic storms presupposes knowledge of normal conditions.

Outside magnetic observatories, where shall we find knowledge and experience for true comparison of normal with abnormal? Surely in submarine-cable and aerial-trunk-line telegraph stations—a fact borne out by a mass of matter at our disposal in back numbers of the *Journal* I.E.E.: Papers, lectures, communications and discussions connected with names such as J. S. Adams, C. Dresing, James Graves of Valentia, H. A. C. Saunders, Willoughby Smith, G. K. Winter, and others. All this good work, however, did not prevent a past president of the Institution, Lord Kelvin, from making an urgent appeal to cable electricians to profit by every opportunity for acquiring additional information relating to terrestrial electric disturbances, and to *earth currents* in general.

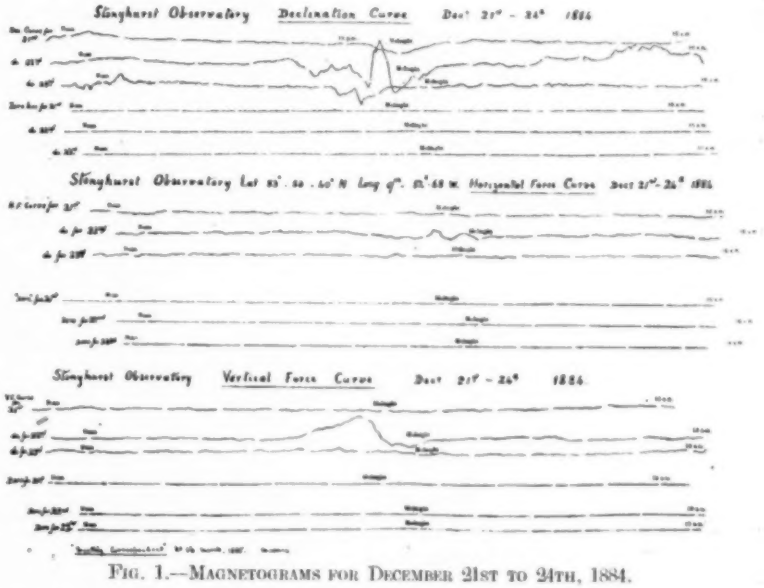

Stonyhurst Observatory Declination Curve
Stonyhurst Observatory Horizontal Force Curve
Stonyhurst Observatory Vertical Force Curve

Fig. 1.—Magnetograms for December 21st to 24th, 1884.

Fig. 1 refers to the question whether a sharp shock of earthquake felt at Funchal, Madeira (Lat. 32.37 N., Long. 16.54 W.) about 3 a.m. on December 22nd, 1884, had synchronised with any abnormal disturbance on the magnetographs at Stonyhurst College Observatory in Lancashire, England. For some weeks previously disastrous earthquakes in Spain had caused much loss of life.

* Elec. Rev., p. 540; May 9th, 1919.

Fig. 1, for which, in 1884, the writer was indebted to the Rev. Fr. Walter Sidgreaves, S.J., shows Stonyhurst magnetograms for December 21st-24th, 1884.

Allowing for difference in time, the point on the Stonyhurst top line declination curve synchronising with the earthquake occurrence in Madeira is just to the left of the 4 a.m. (December 22nd) clockwork-screen record break.

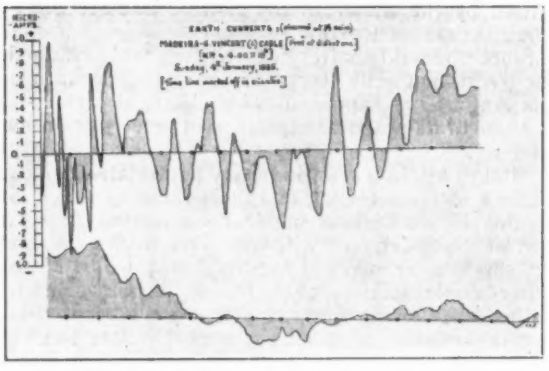


Fig. 2.—Earth-current Records.

16 to 20 hours later, at the centre of the second line from the top, we observe a considerable magnetic disturbance or "storm" as registered in Lancashire. Is there any connection between these two sets of occurrences? What is certain is that strong magnetic disturbances evident to the right of second line, and to the left of third line (October 23rd), synchronised with earth currents on the cables, not only at Madeira, but on all the cables between Europe and Brazil—earth currents so strong and so insistent in successive *positive* and *negative* peaks as, in the personal experience of the writer, to render impossible for some days the obtaining of any regulation routine test records, whether by galvanometer or by electrometer fall-of-charge methods. Owing to the salutary effect of the cable condensers, signalling through the cables was in no way interfered with.

On Sunday, January, 4th, 1885, advantage was taken of slackness in message traffic to obtain earth-current records from one of the Madeira-St. Vincent cables, as shown in fig. 2, a vivid picture, indeed, of what apparently was the tail end of an electric "storm."

Cable earth-current liveliness continued, on and off, for some time, though never in any way interfering with traffic. Early, therefore, in February (1885) the writer organised E.C. observations on one of the Madeira-Lisbon cables. One object in view was the corroboration of Chr. Dresing's observations as summarised by him in the *Journal* of the S.T.E. and E. (now I.E.E.), No. 36, Vol. X. April, 1881; but with special reference to what had been pointed out to Dresing by a Scotch friend, namely, that change in the direction of the earth current (on the Scotch-Norwegian cable) coincided with change—that is, with ebb and flow—of the sea tides.

Fig. 3 shows the result of this Madeira investigation. Considering the abnormal electrical disturbance which prevailed in the cables for some considerable time following upon the earthquake, fig. 3 corroborates Dresing very satisfactorily. "M" and "N" on the time line denote "Midnight" and "Noon."

Cable E.C.'s observed (1) with distant end *free*, and (2) with distant end *earthed*, are in totally different categories as regards both cause and effect: a subject fully dealt with by the writer in articles on

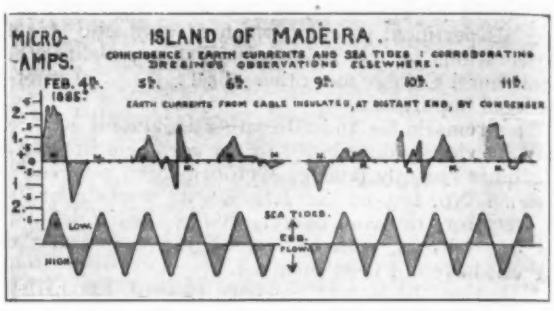


Fig. 3.—Earth-current and Sea-tide Records.

"Unusual Earth Currents" in *The Monthly Correspondent* (Madeira) of 1885.

Figures 2 and 3 have referred to E.C.'s observed when the distant end of the cable has been "freed," *i.e.*, insulated.

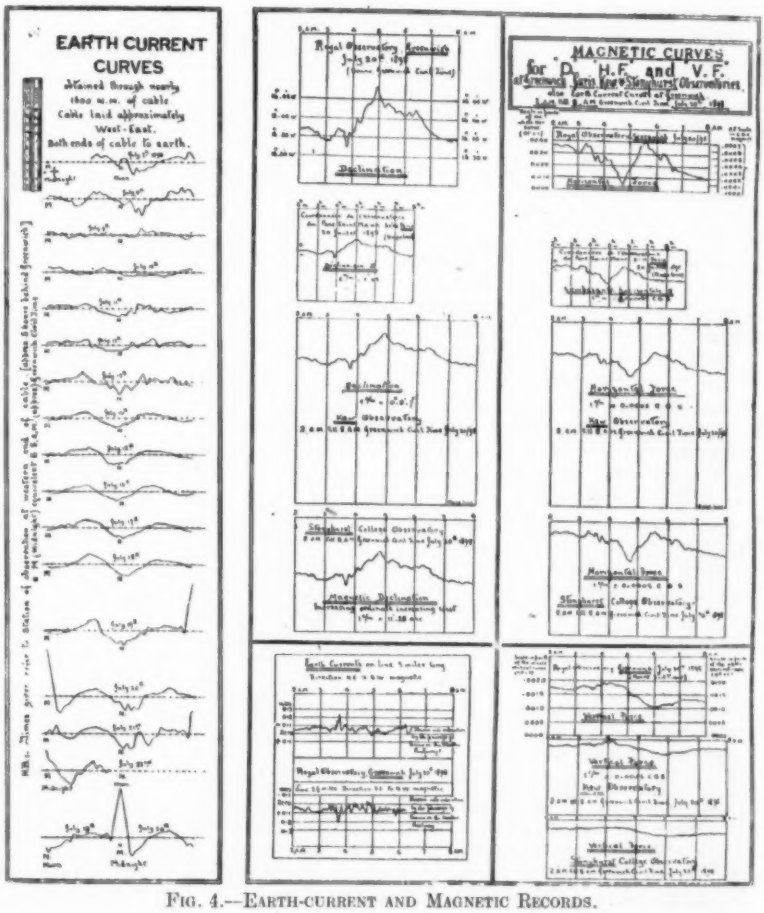


Fig. 4.—Earth-current and Magnetic Records.

The 16-day series of E.C. records shown to the left of fig. 4 were obtained in 1898 by the writer and four enthusiastic assistants, from 1562 N.M. of cable *both* ends of which were *to earth*, *i.e.*, through a mirror speaking-galvanometer at the Massachusetts

observing end, and in mid-Atlantic at the far end. In fig. 4 a graduated scale gives a measure of resulting current and E.M.F. values in terms of milliamperes and volts.

Heavy weather delayed the cable-ship's operations, thus affording opportunity for E.C. day and night observations during 362 hours.

These records present two very striking features. (1) The consecutive curves for the five days, July 14th-18th, constitute a valuable record of normal E.C. conditions across the North Atlantic.

(2) The records for July 19th-20th show a remarkable instance of an *electric storm* rising about midnight in one hour to a peak of 33 volts and (taking into account the resistance of observing galvanometer) 6.5 milliamperes *negative*, followed by a back swing peak of 13 v. and 2.4 *m.a. positive*.

Greenwich, Kew, Paris and Stonyhurst declination, horizontal-force, and vertical-force magnetograms recorded at and about 5 a.m., G.T.—equivalent to five hours earlier, *i.e.*, midnight on the coast of Massachusetts—indicate abnormal magnetic disturbance synchronising with the 33-volt cable E.C. peak.

The present writer draws attention to these magnetograms with all the greater pleasure in view of the fact that it was Dr. Charles Chree, F.R.S., himself, to whom, in 1898, the writer was indebted for the Kew records here shown, whilst it was to the Rev. Father Walter Sidgreaves, S.J.—appreciatively mentioned by Dr. Chree in his recent I.E.E. lecture*—that the writer was beholden for the corresponding Stonyhurst magnetograms.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

SCOTTISH CENTRE.

At the opening meeting of this Centre, in Glasgow, on November 11th, Mr. J. F. Neilson, the retiring chairman, recalled that that was the twentieth session of the Centre. Now that the war was over, he said, there was a danger that people, unscientifically trained, would make the grave mistake of supposing that the war was brought about by Germany's devotion to science, and not by her degradation of science. It was the duty of engineers and scientists to educate the masses of the people so that this age of democracy would be "safe for the world." Engineers had done something in the past to educate the masses; much more remained to be done if the peace of the world was to be secured on a lasting foundation. He referred to the successful inauguration of the Aberdeen sub-section, and said it was hoped before the end of the present session to inaugurate a similar sub-section at Dundee.

In the course of his inaugural address, Mr. W. B. Hird drew attention to the tendency towards an increasingly close connection between pure science and its application in engineering and practical work generally. Perhaps one of the most striking instances of this connection between theory and practice was the large use which had been made of thermionic valves—instruments of great practical utility which were manufactured in quantities by comparatively unskilled labour, and which required no great amount of training in those who used them to give useful results. The study of the electron had occupied the most eminent men in science, and most remarkable results had been obtained, while the investigations directed primarily to considerations of such an abstract subject had rapidly developed into so concrete a result as the production of the thermionic valve. Following a description of the valve, Mr. Hird compared it with the rectifiers, relays, and converters which were the best at their disposal before the invention of the valve, and it was easily seen how vastly superior was an instrument which instead of having to rely on influencing material moving parts of a more or less clumsy construction dealt with electrons of a mass only a little greater than 1/2,000th part of that of a hydrogen atom. It was necessary, he said, to look at it in this way in order to realise the possibility of the results actually obtained in practice. A totally different direction in which science was coming into closer contact with practical work was in connection with the methods of shop organisation. The up-to-date shop organiser was no longer satisfied merely to observe for himself the effect of fatigue, to time and tabulate the different motions gone through in carrying out any operation, but he called in the assistance of the physiologist and the psychologist to devise laboratory experiments, and to draw on their experience in quite different spheres to advise him as to the proper proportion of work and rest periods, to discuss the different results of nerve and muscle fatigue, and the mental attitude produced in different groups of workers by changes in their environment. After quoting various other examples of scientific research during the war, Mr. Hird turned to the future, and said they could scarcely hope—perhaps they ought not to hope—that the rapidity of adaptation of scientific discovery to practical work developed in quite abnormal times, would continue under more normal conditions, but they might not unreasonably hope that the closer connection and the more rapid adaptation of scientific discoveries, would to a large extent be maintained under the new conditions they were all looking forward to, and it was gratifying to note that among the many projected reforms, the setting up of research laboratories by large industrial concerns and the stimulating of an increased public interest in scientific work were not forgotten. They were all convinced that improved methods of obtaining and distributing power were the important factors in obtaining better conditions of life. To the engineer the fact was patent, and even the writers of modern social Utopias all found it necessary to postulate large developments, although in their case vague and obscure development in the methods of obtaining and transmitting energy in order to be able to attain their standard of ideal existence. Already in the ionic valve they were making some practical use of atomic energy. In wireless telegraphy they were transmitting not inconsiderable quantities of energy to great distances without material connection, and surely if further developments did follow, whether in the immediate or the distant future, they would be so intimately connected with the work of the electrical engineer that he would perforce take a leading part in bringing them about.

TEES-SIDE SUB-SECTION.

At a meeting of the Tees-side Sub-section on the 13th ulto., Mr. J. R. P. Lunn, chairman, delivered his inaugural address, in which he outlined recent progress in the electric supply industry, and drew attention to a number of problems in need of investigation. He first referred to the Electricity (Supply) Bill before Parliament, and the changes that had been, and were being, made in its character. The enormous increase since 1914 in the cost of electrical generating and distributing plant had given rise to many new problems in connection with electricity supply. For instance, an increase in output which necessitated additional generating and distributing plant, as must generally be the case where the increase was considerable, meant an increase in the cost per unit sold, instead of the reduction in cost which they were accustomed to look forward to with a growing output. This was due to the increased capital charges. The increased cost of labour and coal had caused more attention to be paid to the development and use of water-power, and schemes were in hand to establish water-power stations on certain rivers to work in conjunction with existing steam generating stations. As the cost of harnessing water-power had increased more or less in the same proportion as the cost of labour and coal, the relative costs of electricity generated by steam and by water would appear to be not very different from what they were before the war. The increased cost and labour would induce power users, who produced their own power by antiquated methods, to obtain energy from an outside source, and would result, too, in the substitution of electrically-driven machinery for hand labour to an increasing extent. The larger output of all kinds of manufactures needed to replace the world's depleted stocks, should, also, lead to an increased demand for electricity. The prospect before the electricity supply industry, therefore, was one of a continually increasing demand for many years to come. The adoption of summer time, and the 47-hours' week had had an adverse effect on the load factor, and a correspondingly adverse effect upon the cost per unit. Unless manufacturing works adopted the two- or three-shift system more generally than at present, it would be more necessary than ever to find some class of consumer who would take a supply during the night only. Where generating systems could be linked up, considerable saving might be effected in the running costs by entirely closing down one, or more, generating stations during the light-load periods, but the cost of the capital and the other charges incidental to linking-up had to be set against the saving to be effected in this way, and, consequently the net saving might be very small. The most economical method of generating electricity in large quantities still seemed to be by means of coal-fired boilers and steam turbines. It would be a great advantage to the nation if electricity could be so generated that the valuable by-products of the coal could be recovered without increasing the net cost of the electricity produced, but so far no such process seemed available. The sizes of turbo-generators and boilers and the working pressure and temperature of the steam, continued to increase with a corresponding increase in the thermal efficiency. Where the adoption of large units of generating plant depended on the transmission of electricity over long distances the increased

* Since Dr. Chree's lecture Father Sidgreaves has died.

thermal efficiency was liable to be outweighed by the enhanced transmission costs. It was more than ever necessary to pay close attention to the efficiency of the generating plant, and especially to the steam-raising portion. The cost of employing more highly skilled men in the boiler-house might be quite inappreciable compared with the saving to be effected by a more efficient combustion of the fuel. If a satisfactory system of payment by results could be devised it would have a very beneficial effect upon the working efficiency although power station staffs were usually keen enough to strive for the best results without monetary inducements. Considerable improvements had been made in the methods of burning low grade fuels. If an appreciable proportion of the heat rejected in the condensing water could be utilised, instead of burning more fuel, the overall thermal efficiency of an electric power station might easily be doubled. This heat might be utilised in certain manufacturing processes, or it might be used to provide a general supply of hot water for heating domestic and business premises. When power loads were being connected in hundreds of kilowatts at a time, there was a tendency to underrate the importance of connecting small lighting consumers, but it was the duty of electric supply engineers to encourage the use of electricity for all purposes, as it was to the advantage of the community that a supply of electricity should be available for the greatest number, and it was only by increasing the "consumer factor" on distributing mains that this could be done. Having referred to the provision of mains, Mr. Lunn said that even before the mains became overloaded by the heating and cooking load, difficulties arose in maintaining the balance of the three-wire system, and for that reason it would be a great advantage if cooking and heating apparatus could be connected to the "outers" of the three-wire system. One way of dealing with those troubles was to substitute a L.T. three-phase supply for the more usual D.C. supply, with transformer pits at frequent intervals, but that involved laying additional H.T. mains, providing the transformer equipment, and changing meters, motors, &c., and the question arose as to what charge should be made for heating and cooking supplies in order to cover the cost of these additions to the capital charges on the distributing system. More exact data were required as to the load factor and diversity factor for cooking and heating loads, in order that the lowest remunerative charge at which these supplies could be given might be determined. An investigation into the relative costs of supplying electricity for lighting and for power would be also very useful. An improved system of charging for lighting, cooking, and heating supplies was urgently needed as none of the systems in use at present were really satisfactory. What was wanted was a system that would allow small supplies to be registered by one meter which should not be appreciably more costly than those in general use. In conclusion, Mr. Lunn spoke of the progress made in the use of electricity for agricultural purposes, and the use of electric battery vehicles.

SOUTH AFRICAN ELECTRICAL UNDERTAKINGS.

LIGHTING AND POWER.

We give below particulars of South African electricity supply undertakings which we have extracted from the *Supplement to the Official S.A. Municipal Year Book*, compiled by Mr. E. Poole, A.M.I.E.E., Assistant Borough Electrical Engineer, Durban.

Under the heading of each township the data appear in the following order:—

Name of engineer or manager; source of power; kind of supply, phase and voltage; number of units sold per annum; plant capacity in kw.; number of consumers supplied.

If there are tramways also, a note is made to that effect.

ALIWAL NORTH: P. H. Newcombe; water and oil; d.c., 230/460 v.; 80,925 units sold; 170 kw.; 256 consumers.

ESTHEL: G. Mercier; s. gas; d.c., 250 v.; 21,828 units; 20 kw.; 56 cons.

BETHLEHEM: M. McDonough; gas; d.c., 480/240 v.

BLOEMFONTEIN: G. A. Stewart; steam; a.c., 3 ph., 200 and 347 v.; d.c., 500 v.; 2,258,390 units; 1,650 kw.; 1,935 cons. Tramways also.

CAPE TOWN AND SUBURBS: G. H. Swingler; steam; a.c., 2 ph., 50 c.; various voltages; d.c., various voltages; 14,082,971 units; 8,900 kw.; 7,703 cons.

CERES: P. S. C. Spies; water; d.c., 145/110 v., 2 wire; 9,000 units; 23 kw.; 78 cons.

CRADOCK: H. Brittle; oil; d.c., 220/440 v.; 48,943 units; 100 kw.; 359 cons.

DURBAN: J. Roberts; steam; a.c., 3 ph., 500 v., 50 c.; 1 phase 100, 200 and 400 v., 62 c., 2 and 3 wire; d.c., 550/500 v.; 21,881 units; 10,000 kw.; 8,223 cons. Tramways also.

EAST LONDON: J. M. Lambe steam; a.c., 2 ph., 50 c., 110 v.; d.c., 500/550 v.; 1,596,304 units; 1,700 kw.; 1,887 cons. Tramways also.

ERMELO: C. D. Douglas; steam; d.c., 250/500; 49,468 units; 50 kw.; 197 cons.

GREYTOWN: W. H. Blatchford; steam; d.c., 200 v.; 84,616 units; 74 kw.; 210 cons.

HARRISMITH: T. Millar; steam; a.c., 200 v., 3 ph.; 127,000 units; 185 kw.; 339 cons.

HEIDELBURG: E. J. Stanley; gas; d.c., 440/220 v.; 28,395 units; 45 kw.; 184 cons.

HEILBRON: W. G. Miller; gas; d.c., 230 v.; 29,432 units; 65 kw.; 166 cons.

JOHANNESBURG: J. H. Dobson; steam; 1 ph., 400/200 v., 50 c., d.c., 460/230 v.; 26,534,241 units; 13,750 kw.; 18,855 cons. Tramways also.

KING WILLIAMSTOWN: J. Vowles; steam; a.c., 220 and 460 v., 1 ph.; 443,845 units; 320 kw.; 421 cons.

KLERKSDORP: J. R. English; gas; d.c., 230/460 v.; 118,090 units; 70 kw.; 243 cons.

KROONSTAD: R. A. Stoker; steam; d.c., 230 v.; 488,238 units; 180 kw.; 1,130 cons.

KRUGERSDORP AND RANDFONTEIN: R. W. Fletcher; steam; d.c., 230/460 v.; 795,041 units; 1,171 cons.

LADYSMITH: T. Jagger; steam; d.c., 220/440 v.; 397,273 units; 475 kw.; 374 cons.

NEWCASTLE: G. H. Dawson; steam; d.c., 230/460 v.; 61,654 units; 156 kw.; 243 cons.

OUDTSHOORN: F. Castle; oil; d.c., 230/440 v.; 165,937 units; 305 kw.; 569 cons.

PAARL: H. Purves; water; 220/380 v., 2 ph., 50 c.; 44,886 units; 150 kw.; 38 cons.

PARIJS: W. McKenzie; steam and water; d.c., 230/460 v.; 33,293 units; 70 kw.; 105 cons. Steam plant not yet in use.

PIETERMARITZBURG: A. S. Munro; steam; 3 ph., 2,300 v., 60 c.; 1 ph., 200 v., 100 c.; 2,299,416 units; 2,199 cons. Tramways also.

PORT ELIZABETH: B. Sankey; steam; 1 ph., 250 v., 3 ph., 6,600/500 v., 50 c.; d.c., 250/500 v.; 2,854,907 units; 3,500 kw.; 2,765 cons.

POTCHEFSTROOM: W. D. Ross; steam; d.c., 550/500 v. and 240/480 v.; 147,178 units; 120 kw.; 500 cons.

PRETORIA: T. C. Woolley-Dod; steam; d.c., 250/500 v.; 5,544,780 units; 3,200 kw.; 4,460 cons. Tramways also.

QUEENSTOWN: W. Bellad-Ellis; oil; d.c., 230/440 v.; 163,000 units; 200 kw.; 765 cons.

SOMERSET EAST: H. T. Steadman; oil; d.c., 220 v.; 40,161 units; 70 kw.; 210 cons.

SENEKAL: R. Rascher; gas; d.c., 230/460 v.; 12,376 units; 45 kw.; 126 cons.

STELLENBOSCH: E. J. Hamlin; oil; d.c., 230/440 v.; 78,648 units; 80 kw.; 349 cons.

UITENHAGE: R. H. Molesworth; oil; d.c., 220/440 v.; 148,655 units; 270 kw.; 654 cons.

VRYHEID: B. H. Sargent; s. gas; d.c., 200 v.; 26,240 units; 27 kw.; 161 cons.

WELLINGTON: E. S. Mould; s. gas; d.c., 220/440 v.; 124,100 units; 96 kw.; 264 cons.

WINBURG: W. A. Hodge; gas; d.c., 230 v.; 37,843 units; 36 kw.; 141 cons.

WORCESTER: C. Duncan; water and oil; d.c., 220/440 v.; 60,199 units; 127 kw.; 283 cons.

Municipal bulk supply.

BOKSBURG: F. R. Clark; a.c., 230 v., 50 c.; 600,000 units; 400 kw.; 1,120 consumers. Tramways also. Supplied from Victoria Falls Co.

BENONI: P. J. Gold; a.c., 3 ph., 25 c., 200 and 346 v.; 750,000 units; 520 kw.; 1,800 cons. Motor 'buses also. Supplied from Kleinfontein Co.

GERMISTON: W. L. Bagot; ac., 3 ph., 50 c., 120 and 200 v.; 1,758,718 units; 2,000 kw.; 1,777 cons. Tramways also. Supplied by Victoria Falls Co.

KIMBERLEY: R. W. H. Smith; a.c., 1 and 3 ph., 50 c., 220 v.; 931,038 units; 1,260 kw.; 1,679 cons. Trams owned by De Beers Co. and energy supplied by them.

ROODEPORT: R. Mortimer; a.c., 3 ph., 50 c., 230/400 v.; 184,094 units; 225 kw.; 799 cons. Supplied by Victoria Falls Co.

STANDERTON: W. Leonard; d.c., 230 v.; 42,263 units; 75 kw.; 190 cons. Supplied by S.A. Railways.

SPRINGS: C. M. McComb; a.c., 50 c., 200 v.; 130,530 units; 265 kw.; 248 cons. Supplied by Victoria Falls Co.

Private company supply.

BUTTERWORTH: W. Kemlo; s. gas and water; d.c., 220 v.; 30 kw.; 91 consumers. Supplied by Viedge Bros.

DUNDEE: E. H. Gellender; steam; d.c., 220 v.; 175 kw.; 224 cons. Supplied by E. H. Gellender & Co., Ltd.

INDWE: G. Muller: steam; d.c., 550 v.; 30,500 units; 300 kw.; 62 cons. Supplied by Indwe Railway, Collieries & Land Co.

VOLKSRUST: R. Nisbet; steam; d.c., 120/240 v.; 100 kw.; 150 cons. Supplied by E. H. Gellender & Co., Ltd.

Rhodesia.

SALISBURY: C. H. Paskerville; oil and steam; d.c., 220/440 v.; 204,478 units; 200 kw.; 713 cons. Municipality.

BULUWAYO: ———; steam; a.c., 1 ph., 125 c., 105 v.; 350 kw.

TRAMWAYS.

The following statistics of tramway undertakings are given in the order in which they are enumerated:—Name of municipality; name of engineer or manager; kind of system; voltage; route miles; annual car miles; number of passengers carried.

BLOEMFONTEIN: G. A. Stewart; railless; 550 v.; 10.36; 211,880; 1,123,577.

DURBAN: H. N. Thomas; trolley; 550 v.; 20.4; 1,785,512; 19,011,586.

EAST LONDON: J. M. Lambe; trolley; 550 v.; 3.78; 276,705; 3,583,421.

JOHANNESBURG: J. H. Dobson; trolley; 550 v.; 65.74 (track miles); 3,429,979; 34,149,013.

PIETERMARITZBURG: P. Finlayson; trolley; 500 v.; 8.25; 245,250; 2,238,651.

PRETORIA: T. Wolley-Dod; trolley 500 v.; 9.67; 571,024; ———.

Municipal bulk supply.

BOXBURG: F. R. Clark; railless; 500 v.; 2,3 (route miles); 109,640; 620,363.

GERMISTON: J. Bright; railless; 500 v.; 9.5; 178,000; ———.

Private company supply.

CAPE TOWN: W. F. Long; trolley; 550 v.; 22; 2,180,491; 21,828,055; owned by City Tramway Co., Ltd., and Capetown and Greenpoint Tramway Co., Ltd.

CAMPS BAY: W. F. Long; trolley; 550 v.; 6.87; 221,608; 902,105; owned by Camps Bay Tramway Co., Ltd.

KIMBERLEY: ———; trolley; 550 v.; 24; 449,279; 3,071,684; owned by De Beers Co.

PORT ELIZABETH: W. Freemantle; trolley; 550 v.; 549,739; 4,573,843; owned by Port Elizabeth Tramways Co., Ltd.

The Metallurgical Industries of Italy.—Owing to the shortage and increased price of coal in Italy, which, of course, has practically no coal deposits of its own, the question of smelting by means of electrical furnaces has received serious consideration. The deciding factor is primarily the comparative cost of coal and electricity, the ton and the KW.-hr. It has been established by Signor Remo Catani that the cost of electricity as compared with coal is in the ratio of 2 to 1, but in view of the fact that increased freights are forcing the price of coal to further heights, it is considered that the ratio will be considerably diminished, and bring the two costs in closer relation to one another. Therefore, although the substitution of electrical treatment for the present process will help to solve the problem facing the Italian manufacturers, it cannot be expected to improve their position, but will merely prevent retrogression. During the war the project for utilising the large deposits of hematite ore at Cogne in the Val d'Aosta and converting them into high-class steel, resembling the Swedish product, by means of electricity, has taken shape, and very soon steel manufactured by this process will be on the market.—*Anglo-Italian Review.*

SCIENTIFIC MANAGEMENT: A SOLUTION OF THE CAPITAL AND LABOUR PROBLEM.

By Captain J. M. SCOTT MAXWELL, B.Sc., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The first attack of science against rule-of-thumb methods in industry was directed to the problem of finding the true solution of the various factors governing machine-shop practice. The late Dr. F. W. Taylor, of Philadelphia, started his epoch-making experiments in the autumn of 1880 and carried them on over a period of 26 years at a cost of £30,000 to £40,000. The first paper describing the fundamental idea of what is now called Scientific Management was read by Dr. Taylor in 1895. This paper explained the method of fixing rates by means of splitting a job into its elements, which Taylor called elementary-rate-fixing. It also explained his method of payment-by-result by means of the differential-piece-rate, which increases the rate per piece for high outputs. The great new fact was elementary-rate-fixing which is a basic principle, a scientific discovery.

Before the war the term was seldom heard in this country, and the few occasions when a British engineer had the temerity to use it almost invariably evoked scorn. Though Scientific Management is now seldom scorned by engineers, there is still almost the same failure to grasp the great significance of the principle.

The real cause of the strong opposition is that Scientific Management is the first system to realise that the human factor must come first. This is a revolutionary idea to the capitalist, who still considers that he comes first. Scientific Management is revolutionary to the trade unions because it enables work to be accurately measured for the first time in the history of industry. To many socialists and social reformers it is also revolutionary because they think that it is better for the character of the worker that he should use his own initiative as to how the work should be done, even though he has only rule-of-thumb to guide him.

The author's excuse for dealing at length with the principles of the subject is that Taylor himself and the pioneers of the movement, who are all engineers, regard the new mental attitude, which it makes obligatory, as the very essence of the system. All the devices used in office and shop as means of efficient production, they consider in the same light as mechanisms, *i.e.*, of secondary and not primary importance.

Manufacture by machine is hardly a century old, and this past century of machinery inherited the traditions of the preceding centuries, which were evolved by the trader and not the producer. The traders' ideal has always been to buy in the cheapest market and sell in the dearest. They risked much capital in the past and employed little labour, while their profits bore no relation to costs but were regulated entirely by supply and demand. Engineering advance has changed everything, and now the big men are producers, but the prestige of the merchant is still maintained and also the prestige of those associated with him, such as the bankers, while the engineering profession, the creator of our modern wealth, does not yet enjoy the prestige that is its due. Merchants prefer a high profit on a small turnover. Production requires low profits on a large turnover. The merchant system restricted the supply and thus lessened the consumption in order to maintain or increase prices. The production system cheapens the supply in order to maintain or increase the demand and thus maintain or increase consumption. The merchant system favoured the wealthy, and developed aristocracies. The production system favours the proletariat and thus develops democracy. The merchant system at the best did not raise the status of the workers. The production system must continually raise their status by continually raising the standard of living. The confusion of these ideals is very great at the present time amongst all classes of the people, and until they are disentangled and the one set encouraged and the other controlled we are bound to have continual industrial trouble. It is necessary that our economic conceptions should synchronise with the facts. At present they are entirely out of step.

In applying the principle of cheap production, it must not be confused with the act of buying commodities. Labour must cease to be regarded as a commodity, which is one of the worst legacies of the old system. Labour in the abstract may be a commodity, but in the concrete it is human life. Increased output and payment-by-result is the sound foundation on which to build, but it ought to include everyone, from the managing director down, and both these aims should be qualified by another—a better life for the worker. Scientific Management increases output, and because it can accurately measure the work done in terms of human effort, payment-by-result is the fair and natural sequel. It achieves this greater output by lessening the task and raising the status of the worker.

Scientific Management affects the individual as a unit worker, the workers as a group, and therefore trade unionism, and it affects all industry in its relation to the Government and to the consumers, and thus involves the whole nation. Taylor realised, without any question, that the ultimate goal of Scientific Management was its application to all industry in the interest both of the producer and of the consumer, that is, in the interest of the whole of society. Ten years ago, when Scientific Management won its first public recognition, the unions were thereby aroused and brought pressure to bear on the American Government. It was a political fight and Taylor was no politician. The Government had to give in, and since then Scientific Management is forbidden in any Government workshop in the United States. Taylor's own words on this subject refute those who denounce him: "The labour unions—particularly the trade unions of England—have rendered a great service not only to their members, but to the world, in shortening the hours of labour and in modifying the hardships and improving the conditions of wage workers." Taylor was an idealist with the real interest of the worker, the industry, and the State at heart.

The better and further development of trade unions in Great Britain makes the situation in this country a much brighter one. I do not see how Scientific Management can progress at all unless the unions are included in its scheme. Progress will only commence in earnest when the labour leaders grasp the full meaning to the worker of the elimination of useless work, which will lessen the total burden of labour; and when they realise that the accurate measuring of work protects the worker from underpayment, and that the greater all-round efficiency makes shorter hours and higher wages a just claim on the community.

Some seek to belittle Scientific Management by saying that it is only applied common sense. Common sense discovers nothing. Its function is to accept all that proves good for humanity. If Scientific Management is therefore considered only common sense, it means that this instinctive arbiter of our lives considers it to be good for us. If the instinctive sense of the few accept it, it is certainly not accepted by the common sense of the many, and especially the workers. The thinking part of the community have to fight until it is accepted by the majority in the same manner that they accept wireless telegraphy, aeroplanes, or any of the great achievements of science.

Motion and Time Study.

What Taylor first described in 1895 as elementary-rate-fixing is now more usually called Motion and Time Study. Scientific rate-fixing involves three problems:—

(1) The analysis of the job into its elemental operations by means of an investigation into the best method of accomplishing the desired result.

(2) The execution of the job by a first-class man, with tools and equipment of the best possible, and the timing of each elemental operation thus carried out.

(3) The investigation of the factors of environment and nature of the work as it affects the physical and mental capacity of the worker.

This third factor has been called the "fatigue" factor, but a better word to adopt might be "rest" factor, as this factor is the period allowed for rest so that the worker will not be fatigued.

Where a job has already been performed in the usual rule-of-thumb manner, motion study always comes first. Where a new job is to be performed for the first time under the Taylor method, motion study or analysis may not be necessary, as sufficient data may already be in existence to give both the best method and the correct times. The process of fixing rates then becomes a synthetic one.

Scientific Management applies to the expenditure of human effort the same principles that have been already applied to design with such marvellous results.

Scientific Management started in the machine shop, where it divides all work into two parts:—

(1) Work done by the workman.
(2) Work done by the machine.

Taylor had to concentrate first on the machine part to find an answer to the three problems that every machinist must solve in some way or other, viz.:

(1) What tools to use?
(2) What cutting speed to use?
(3) What feed to use?

Taylor gives 12 variables in the solution of these three problems, as regards turning work. The experiments consisted in keeping all but one variable fixed, and varying that one over the working range. Mr. Carl G. Barth, a Norwegian technical graduate, who joined Dr. Taylor in 1899, invented a wonderful series of slide rules by means of which Dr. Taylor asserts that a good machinist "can double the output of a machine which has been run, for example, for 10 years by a first-class machinist having exceptional knowledge of and experience with his machine and who has been using his best judgment." He also adds that "on the average, this understates the fact." No more obvious example can be found of the value of applied science in eliminating unnecessary work.

The direct saving of over 50 per cent. is also indirectly increased by the great improvements in machine-tool design, tool steel, belt drive and everything affecting machine work, which arose out of these experiments.

The other part is to analyse the various movements of the man using the machine, and these can be subdivided into three parts:—

(1) Handling of tools.
(2) Handling of machines.
(3) Handling of material or job.

The first is the most important and represents about 75 per cent. of the total time. The handling of the machine comes next with, say, 15 per cent., and the job itself only requires about 10 per cent. of the total time. The times required to perform the various operations on any machine must be tabulated and arranged so that they are easily and quickly available, like the actual times for the machine work. Most work can be reduced to comparatively few elements.

Machine work lends itself to the most obvious and at the same time highly scientific analysis, but the same principle applies equally to fitting, assembling, and all human operations. In fact, it would be almost as difficult for the science of chemistry to exist without quantitative analysis, as for Scientific Management to exist without elementary time study.

Motion and time study give the minimum time for the job under the best possible conditions with all rest pauses eliminated. Should a better machine or tool be designed, the new time for these new conditions is arrived at in a similar manner. The Taylor system does not demand the best known tools. Each factory must work with the best tools available to it. Taylor's method applies to the worst possible tools, but if an employer considers it good policy to use old and out-of-date machinery, he must pay more for his output, because the standard times will require to be higher.

Fatigue or Rest Factor.

The objective before us is to set "times" so that not only is there no overstrain at the actual time of operation and no loss of interest in the work done, but that there is no chance of physical or mental hurt resulting to the worker in the future from the work done to-day. In this field of investigation we leave the province of the engineer for that of the physiologist and psychologist. Taylor and the early pioneers had practically no assistance in this direction, and not being experts in this field they had to work almost solely on common-sense lines. It is up to the medical profession to concentrate on their part of it.

It is interesting to all who believe in scientific management that the Government and public opinion are at last waking up to the necessity for industrial hygiene. The Government, however, seems to ignore Taylor's discovery. The ignorance of employers, and especially of the Government, which urged heavy overtime during the first years of the war, brought about abnormal fatigue amongst many of the munition workers. Because of this evil experience, the Government is now interested in industrial fatigue, and sooner or later the experts are bound to see that an accurate knowledge of fatigue will also demand the standardisation of normal industrial conditions and the means of accurately measuring the human effort required to produce a certain result.

In December, 1917, at the instigation of the Secretary of State for Home Affairs, a Research Board was appointed by the Department of Scientific and Industrial Research and the Medical Research Committee jointly "to consider and investigate the relations of hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers. The duty of the Board will be to initiate, organise and promote by research grants or otherwise, investigations in different industries with a view to finding the most favourable hours of labour, spells of work, rest pauses and other conditions applicable to the various processes according to the nature of the work and its demands on the worker."

The Board, as constituted, consists of six medical experts, one being a psychologist. There are in addition four non-medical Government officials and three directors of large companies. The two distinct functions involved in this investigation and pertaining to the engineering and medical professions should not be confused, and from this point of view the constitution of this Board seems wrong. The employer members should belong to another Board of engineering and production not business-experts, and one-half of this Board should consist of representatives of the trade unions, who must be men of actual first-hand experience. The fullest possible collaboration and co-operation between both Boards would be necessary.

We do not employ doctors as rate fixers, why should we employ engineers to study physiology and psychology? At the best we engineers can only be amateurs at it. It will only produce another failure if common sense tries to solve a very technical subject of which it can have no expert knowledge. The principle of Scientific Management must be applied to all such matters. Functions must be differentiated and not mixed up. The doctors and the engineers, both being technical experts, should understand the meaning of function. Why let the politician or Government official muddle us in this manner?

A most fascinating book on this subject is a translation (1918) of "The Physiology of Industrial Organisation" by Professor Jules Amar. This book will be a revelation to most engineers who are interested in the subject. It proves that the physiologists have solved many of the problems of investigation and have already invented the machines which make it possible to apply the results to industry. Instruments have been invented for recording by means of graphs—like any recording electrical measuring instrument—the variation of muscular activity, for example, when filing metal. The same dynamo-graphic instrument has been adapted to other tools and implements such as hammers, shears, joiner's plane, spade, wheelbarrow, &c. By means of these graphs an apprentice or unskilled person can be trained to work in the most efficient manner, *i.e.*, with the least physical effort, also the work of experienced men can be checked and improved if below the best possible standard. The graphs show both the vertical and horizontal components of the muscular pressure exerted by the hands of the worker, and the respirations of the worker are simultaneously recorded, also the measurement of the quantity of oxygen consumed.

The quantity of oxygen used by the worker is an accurate measure of the human energy he has used up. This is calculated by means of the respiration gauge or eudimometer which measures the oxygen inhaled and exhaled. One litre of oxygen is equivalent to 4.9 calories, the large calorie here used being the quantity of heat required to raise the temperature of one litre of pure water from 0 deg. to 1 deg. C. During repose it is found that an adult expends, on an average throughout the year, 2,100 calories in 24 hours, just to keep his body going. The heaviest day of manual work consumes in addition 2,000 to 2,500 calories. Intense brain work, on the other hand, requires almost no calories.

In other experiments, actual fatigue can be temporarily produced and the blood circulation measured by means of the cardiograph (heart-beats), the sphygmograph (pulse), and the oscillometer (arterial pressure), which measures the highest and lowest pressures successively. All these graphs can be compared with similar ones made during repose or normal effort. These examples do not exhaust the list of instruments already invented and perfected, but they are sufficient to indicate how much the physiologists have already accomplished.

Four scientific laws have been established equivalent to the well-known laws of physics.

(1) The expenditure of energy is in proportion to the muscular effort of contraction, to its duration, and to the degree of contraction.
(2) The expenditure of energy required to perform a given amount of work diminishes in proportion as the rapidity of the muscular contractions increases.
(3) There is a most favourable effort and a most favourable speed for the performance of the maximum of work with the minimum of fatigue.
(4) A muscle returns more speedily to its condition of repose in proportion as its work has been more rapidly performed.

These details will show the engineer that the physiologist is very much farther advanced than the engineering profession realises, and that he is really in a position to commence important operations at once.

Continual industrial research both in methods of work and in fatigue should be carried out by the Government with the help and co-operation of the employers' federations and the trade unions in each industry. There is an immense amount of investigation to do, and what little knowledge has been acquired has been still less applied. In the application, therefore, as we start almost from zero, a little will quickly make a great difference. The change in mental attitude alone will be an enormous gain to the community. The setting of standard times would probably be done by specially trained experts representing equally the masters and men. This would be done for one entire industry such as engineering, assuming all conditions to be the same. Then each territorial district such as the Clyde, the Tyne, the Midlands, South Wales, &c., would decide if the local conditions were better or worse than the standard for the whole country, and this would give a local factor governing the national standard. This district factor would have nothing to do with the local cost of living, but only with the geographical and climatic conditions affecting the producing capacity of the workers.

In each works expert investigation—also by representatives of employers' federations and trade unions—would be required of the machines, lighting, heating, ventilation, management, in fact everything affecting the capacity of the worker to produce. This would give a shop factor for each individual works. The workers in badly equipped factories and with bad environment would be protected by higher rates and their employers would be thus penalised. Sweating would be impossible. These local adjustments would of course affect both the fatigue factor and the standard time. The times set for all work would be in accordance with the mental and physical effort required to perform the work, not necessarily under ideal conditions but under actual conditions, and such a system would always tend to make the actual approximate to the ideal. This organisation for the expert investigation of national, district, and shop standards or factors follows the organisation of the Whitley scheme, the essentials being that the investigators must be first-hand experts and their functions must not be mixed up.

With the best possible system of management, it is still necessary to give incentive to the worker if maximum output is to be obtained. The Federation of British Industries has published a report condemning profit-sharing as popularly understood and advocating payment-by-result. The report contains the following statement:—

"If the system of payment by results is to become general, it is essential that employers should establish equitable systems for fixing piece rates, and that there should be some reasonable procedure for the sanctioning by an impartial authority of any adjustment which may prove necessary."

Without accurate measurement of work, payment-by-result is only a catchword.

The best incentive to steady and efficient work is provided by a payment to the individual worker as soon as possible after the job is finished. Where times are set by the Taylor method, few mistakes are made. When both masters and men set the time, as I have already described, mistakes are still less likely to arise and can be easily rectified. With correct times it is not necessary to cut the rates as masters have always done on piece work, which behaviour on their part is one of the principal causes of the restriction of output by the men. With Scientific Management the masters do not require to protect themselves by elaborate premium systems which the men do not understand and which thus arouse their suspicion and antagonism. Taylor devised a differential piece-rate system, which was a cross between ordinary piece work and premium bonus. He paid an increased rate above a certain minimum on which the ordinary piece rate was fixed. Even with the fullest instructions the workers require some time to get out of the old inefficient method and become experienced in the new. Taylor's payment system penalises them too much at the start, although quite fair to them afterwards. Mr. H. L. Gantt, one of Taylor's assistants, got over this initial difficulty by developing what he called the "task and bonus" system, which pays a bonus instead of a piece rate, and, when the bonus is not earned, pays the standard time wages. I would point out that Scientific Management does not urge any special system of piece work or premium bonus. Any of them which provides incentive will do, but the simpler the better.

The share of the saving effected which should be allocated to the worker must be determined by the employers' federations and trade unions. The probability is that the saving should be halved, and this is probably more on the side of the worker, because Scientific Management means greatly increased effort and intelligence on the part of the employer, as compared with the present state of affairs.

The trade unions have always professed hatred of both piece work and premium bonus, but more especially the latter, as they think that the former gives the worker more control over his time. With Scientific Management making it possible to measure labour effort accurately, premium bonus gives more steady incentive than piece work, and thus means more output and more pay for the worker. The worker is guaranteed his hourly wages at the start, and if after reasonable time he does not come up to the standard and earn a fair bonus, he must be found other work better suited to him.

Scientific Management makes a study of the man and selects the best man for the job. It differentiates and grades labour, and that is another reason why the trade unions are against it. In the initial stages of the struggle against the employers the unions had to fight on the basis of the average man. Now that the unions have won full recognition in this country so that non-unionists are not recognised in negotiations between masters and men, it seems no longer a sound policy for the unions to continue to penalise their best men by maintaining a medium standard of work and pay for all degrees of skill and experience.

Nothing that has been said regarding Scientific Management and payment by result entrenches on the right of the worker to fight for higher wages. Statistics show, however, that 50 per cent. of strikes are due to local troubles, none of which should arise under Scientific Management correctly applied. The elimination of 50 per cent. of strikes would still further reduce the remainder due to the general industrial atmosphere being so much the clearer.

Scientific Management ceases to deal with labour as a commodity subject to supply and demand, and consequently all employers should pay the same amount for the same service done, irrespective of whether their works are isolated in a country district or situated in a crowded town. The geographical situation of an engineering works should not affect the labour cost to the employer, as this at present affects prices and profits which are not geographical and thus gives unfair advantage. Likewise it should not affect the real earnings of the workers. This is allowed for now by different wages in different districts, so that in order to equalise costs and thus stabilise prices and profits, the employers in districts where living is cheaper and wages consequently lower would pay the difference from the average or highest rate into a common fund to be used for industrial research in the industry concerned. (*To be concluded.*)

Discussion in London.

Mr. Ll. B. Atkinson, in opening the discussion, said that there were some members who thought that such a paper should not have been presented to that institution for discussion; the reason given was that the discussion might tend to become of a political nature, but he was sure that none of those present would take that line; as the author had said, they should discuss the principles of the paper and not go into details. He was particularly interested in the paper because he had himself many years ago timed with a stop watch certain workers and operations in the shops in an attempt to arrive at some fair system of basic rates of pay. There was no doubt that fair rates of pay resulted in greater output, but at the time his experiment was made, employers would have considered it preposterous to pay the worker anything like £5 or £6 per week. In the speaker's opinion, the author had not succeeded in explaining his sub-title to the paper, viz., the solution of the capital and labour problem. One had to understand why the workers were opposed to systems of scientific management. They objected because, after all, the workers always thought of themselves first, and it was a question of suspicion. They explained that production might be increased, but the amount of work was not diminished. It was a matter of educating the worker, and he thought the time was ripe for arriving at a suitable solution of the problem.

Mr. S. Mavor thought the author could not have chosen a more opportune time for his paper, which was closely allied to the problem of to-day, namely, that of increased production. At present there was a great deal of time and effort being wasted; time study might result in increased production, but, in his opinion, the more extended use of machine tools would lead to a still greater output. He had used the Taylor system himself in connection with shell production, and the results had been most interesting and instructive. The author's statements with regard to the analysis of the various movements of the man using the machine might be rather startling to some, but nevertheless he himself had proved them to be correct. For instance, out of the total time spent on a certain operation he had found that the actual cutting time only represented about 7 per cent.

With regard to the author's suggestion that the scheme should be adopted nationally, he thought it would be a grave mistake if the Government were to impose the scheme upon them. The first object to be aimed at was the education of both the employer and the employé; the latter's distrust was born of fear of unemployment, and unfortunately that fear was founded on past experience.

Mr. Robert W. Paul condemned the scheme outright; his experience had been that the efficient worker found his proper level automatically without the aid of elaborate schemes of so-called scientific management. The worker who did his work in an amateur manner should be left alone to find his own cure. The real object to be aimed at was the increase of co-operation in the shop; a more cheerful atmosphere should be created. With regard to fatigue, it was his opinion that the worker became bored by his work much more quickly than tired. The whole thing should be looked at more from the worker's point of view. There was really very little in all the so-called welfare problems, they were a mere bogey. After all was said and done it would take at least two generations to establish any such scheme as the paper advocated.

Mr. Stavenhagen, of the Electrical Trades Union, speaking as Mr. Webb's deputy, gave it as his view that any system of payment by results would rapidly lead to unemployment. The present attitude of labour was founded on distrust, and was justified by past experience. Much had been promised, but promises had not been kept. The speaker did not actually discuss the subject of the paper, but attempted to explain the present-day attitude of Labour to Capital.

Other representatives of Labour who had been invited to take part in the discussion did not avail themselves of the opportunity.

Mr. Dick thanked the author for the excellent manner in which he had expounded Taylor's system of scientific management. There were two main causes which, he thought, prevented its general adoption: they were (1) the opposition of the worker himself, and (2) the attitude of the Trade Unions or their executive officers. At one time a man who became a trade unionist had to be a skilled worker, but later the doors were thrown wide open, and it was claimed that anyone who entered the union, no matter by which door, became a skilled worker. To-day they could not differentiate between their members; they could not define a skilled or an unskilled man. The present position was that the workers were enjoying wages apparently much higher than they had been used to in the past, and they were consequently satisfied to let matters rest as they were; they were actually not so much opposed as indifferent.

Sir Geo. Gibb thanked the author for having given them such an important and useful paper. He, the author, was very enthusiastic, and took a broad view of what the future held in store. Something would have to be done if they were not to be found asleep when the critical time arrived. There were grave times ahead, much more grave, in his opinion, than some seemed to think. There was a very great prejudice against any scheme of scientific management; an idea seemed to be prevalent that it was something very different from what it actually was. The workers did not seem to realise that non-existing wealth could not be distributed; it was first necessary to increase wealth, that was to say, increase production, then the standard of living would rise automatically. The system of payment by result would have to be extended; it

was a great mistake to be afraid of the worker, who was strongly prejudiced. The old secretive policy must be abandoned and the worker approached with facts.

Major Pells explained that scientific management was founded on analytical reasoning; it would be difficult to find men who were more expert in that subject than electrical engineers, and for that reason he was glad the paper had been read before that institution. Some such system as that advocated by the author would have to be adopted, otherwise they would never be in a position to compete in the world's markets. With regard to Mr. Paul's remarks, he was a master who was able to know all his employés, but such conditions as he advocated would be quite out of the question with the huge organisations that would grow up in the future. In his opinion, it would be scientific management, and not mass production that would win the day. No mention was made in the paper of costs, which detracted from its usefulness; what were considered to be expensive experiments were not looked upon with favour in works. Taylor had built his system upwards, but the author apparently advocated building downwards. The first thing to be done was to dispel the worker's suspicions; in the past the worker had been tempted with bait which, when bitten, was found to contain a very large hook. He must be taught that scientific management was all bait, there was no hook, and, moreover, the greatest benefit would fall on the worker himself.

Mr. Vines complained that no one had defined what scientific management really was. He thought a much broader view should be taken of the whole thing. He thought most large works in this country had adopted some form of scientific management; nothing could be manufactured perfectly at once, but if one particular line was concentrated upon, in time a perfect specimen would be produced. The greatest difficulty to-day was the scarcity of competent rate fixers; true, they did fix rates, but not scientifically, and, therefore, constant trouble arose.

Capt. J. M. Scott Maxwell, in briefly replying, said that the solution of the capital and labour problem was a question of what was a just basic rate of pay for the worker, in other words, a fair measure of human ability. The object of scientific management was to establish those basic rates, and once established, they would never need to be altered, because they would be just. Under such conditions, he believed the 40-hours' week could be introduced and a larger output obtained than with the present long hours. He maintained that this country was the only one in a position to adopt the system nationally; individual efforts here and there would not produce the desired effect. In America the conditions, contrary to popular opinion, were quite unsuited to the adoption of the system. There the workers had been exploited, and the Government had been compelled to step in and eliminate the system from all Government organisations. In his opinion, it was the employer, and not the worker, who would have to make the greatest effort. He had not meant to convey the impression that he advocated the Government imposing the system upon the country, but he certainly thought the Government should be a party to it, because it would have to be adopted nationally if it was to be a success. Mr. Paul was evidently a member of the old school, who argued for the elimination of the inefficient worker. But what was to become of him when eliminated? Scientific management eliminated no one, it found work for every man in his most efficient capacity. With regard to the last speaker's contention that the system had been adopted in most works in this country, it was clearly disproved by his statement that rates were not fixed scientifically.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

29,862. "Means of distribution on alternating-current systems." A. M. Taylor. December 1st.
29,868. "Generation and application of high-frequency sound waves." T. F. Wall. December 1st.
29,869. "Electric switches, &c." G. Turnock. December 1st.
29,883. "Attachment for suspension of electric-lamp shades." W. H. Lunn, H. M. Manuel and J. S. A. Primrose. December 1st.
29,889. "Electro-motor with self-contained reducing gear." F. Schroder, H. Schroder (legal representative of F. Schroder). December 1st. (Germany, September 17th, 1914.)
29,914. "Sparking plugs." A. G. Brown. December 1st.
29,933. "Electric-lamp shade holder." J. A. Sargent. December 1st.
29,935. "Radio-receiving system." E. F. W. Alexanderson. December 1st. (United States, April 18th.)
29,936. "Signalling systems." British Thomson-Houston Co. (General Electric Co.) December 1st.
29,955. "Adapters for electric-light fixtures." J. S. Pennefather and W. E. Price. December 1st.
29,977. "Electric switches." Akt. Ges. Geb. December 1st. (Germany, June 13th.)
29,978. "Magneto starters." J. R. M. Stanfield. December 1st.
29,980. "Induction motors." Colner Electromotorenfabrik. J. Bruncken. December 1st. (Germany, February 7th, 1918.)
29,984. "Electric switches." I. Calvete. December 1st.
29,986. "Polar inductor and revolving armature magnetos." H. C. Brown. December 1st.
30,020. "Device for controlling consumption of electricity." J. Cleary and G. J. Philpott. December 2nd.
30,047. "Microphones." H. J. Palmer and Telephone Manufacturing Co. December 2nd.
30,048. "Telephone receivers." R. L. Murray. December 2nd.
30,060. "Electric switches, gas taps, &c." S. Brook and J. Eck. December 2nd.
30,062/3. "Windings of alternating-current dynamo-electric machines." British Thomson-Houston Co., F. H. Clough, and H. W. Taylor. December 2nd.
30,113. "Link-nipple for electrical illuminating-bodies." H. Hubener. December 2nd.
30,119. "Induction motors." Colner Elektromotorenfabrik J. Bruncker. December 2nd. (Germany, March 22nd.)
30,120. "Induction motors." Colner Eelctromotorenfabrik J. Bruncker. December 2nd. (Germany, July 17th.)
30,125. "Dynamo-electric machines." E. Barter. December 3rd.
30,128. "Methods of distribution and transmission in alternating-current systems." A. M. Taylor. December 3rd.
30,130. "Thermionic valve detector amplifier." F. Clark. December 3rd.
30,134. "Electric switches." R. C. S. Jame. December 3rd.
30,155. "Combined commutator and cut-out for electrical high-tension ignition magnetos." E. Hallowell. December 3rd.
30,158. "Apparatus for re-magnetising magnetos." S. Wood. December 3rd.
30,161. "Thermionic devices." J. Scott-Taggart. December 3rd.
30,176. "Devices for measuring electric cables." W. E. Benson and Callender's Cable & Construction Co. December 3rd.
30,185. "Plugs and sockets for electrical fittings." E. Jones. December 3rd.
30,191. "Electric lamps for dash-boards of motor vehicles, &c." E. Hill and Rotax Motor Accessories Co. December 3rd.
30,207. "Thermic telephone systems." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. December 3rd. (Holland, December 4th, 1918.)
30,212. "Electrical apparatus." British Thomson-Houston Co. (General Electric Co.) December 3rd.
30,215. "Method of variable pressure control for circuits operated from batteries, &c." Edison Accumulators, Ltd., and L. Murphy. December 3rd.
30,220. "Manufacture of electrolytic iron." R. A. Craig, D. J. Macnaughton, R. Mather and H. Moore. December 3rd.
30,230. "Electric insulators." Haefely et Cie., Akt. Ges. E. December 3rd. (Switzerland, September 13th.)
30,231. "Electric lamps." E. Alber. December 3rd. (Switzerland, December 13th, 1918.)
30,234. "Sparking plugs." V. Joly. December 3rd.
30,237. "Electric scrubber and sweeper." G. L. Carolan. December 3rd.
30,254. "Starting and speed-regulating apparatus for electric motors of electric vehicles, &c." A. Decorat and E. Testavin. December 3rd. (France, December 4th, 1918.)
30,266. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. December 3rd. (U.S., March 10th.)
30,269. "Junction boxes, &c., for electric circuits." A. Graf. December 3rd. (Germany, May 9th.)
30,270. "Switches for electric installations, &c." A. Graf. December 3rd. (Germany, May 16th.)
30,278. "Sparking plugs." W. A. Clark and H. G. Longford. December 4th.
30,306. "Methods of transmission in alternating-current circuits." A .M. Taylor. December 4th.
30,314. "Motors and their application to railway signalling systems." Automatic Telephone Manufacturing Co. and A. E. Hudd. December 4th.
30,339. "Devices for protection of electrical conductors." J. I. Hall. December 4th.
30,354. "Audible alarms, signalling apparatus and lamps." E. V. Hayes-Gratz. December 4th.
30,355. "Manufacture of thermionic valves, &c." H. L. Crowther. December 4th.
30,356. "Dynamo-electric machines." British Thomson-Houston Co. and A. P. Young. December 4th.
30,358. "Dynamo-electric machines." Siemens Bros. Dynamo Works and J. C. Wilson. December 4th.
30,359. "Dynamo-electric machines." Siemens Bros. Dynamo Works and P. H. H. Jantzen. December 4th.
30,385. "Signalling or indicating devices." G. D. Morgan and W. Morton. December 4th.
30,392. "Electrified door handles and their installation." H. J. Andrews and R. Say. December 4th.
30,396. "Magneto-electric machines." C. E. P. Julien, B. Wolkoff, and W. Wolkoff. December 4th. (France, August 27th.)
30,436. "Sparking-plug testing devices." W. H. McCallum. December 5th.
30,441. "Direct-current series shunt motor." G. Liguori. December 5th.
30,442. "Single-phase transformer." G. Liguori. December 5th.
30,445. "Electro-magnetic low-tension sparking plugs." W. H. Ward. December 5th.
30,476. "Bodies of motor-cars, &c." Fuller's United Electric Works. December 5th.
30,479. "Cooling or ventilation of dynamo-electric machines." G. Schroeder. December 5th.
30,480. "Electric converting apparatus." J. E. Calverley and W. E. Highfield. December 5th.
30,485. "Conducting-leads for electrical apparatus." British Thomson-Houston Co. (General Electric Co.) December 5th.
30,487. "Electro-magnetic wave-signalling apparatus." H. L. Crowther and J. Robertson. December 5th.
30,488. "Electro-magnetic wave-reception apparatus." H. L. Crowther and J. Robertson. December 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

7,750. Apparatus for determining the direction of wireless telegraphy and like signals. Duddell, Glazebrook and Smith. May 25th, 1915. (Complete accepted May 23rd, 1916. Patent sealed, June 1st, 1916.)

1918.

8,736. Direction-finding as applied to wireless telegraphy. J. Robinson. May 27th, 1918. (Complete accepted May 9th, 1919. Patent sealed, May 9th, 1919.) (134,660.)

13,167. Variable electric resistances and apparatus employing the same. S. G. Brown. August 13th, 1918. (134,865.)

15,346. Telephone transmitters and like acoustic apparatus. Western Electric Co. September 20th, 1918. (134,872.)

16,482. Electric switches. Simplex Conduits, Ltd., and L. M. Waterhouse. October 10th, 1918. (134,876.)

18,464. Regulating devices for use in electrical machinery. Soc. Anon. Des Etablissements L. Bleriot. July 31st, 1918. (130,575.)

18,467. Processes of electro-depositing magnesium. G. O. Seward. November 19th, 1917. (120,908.)

18,511. Telephone transmitters. J. Skinderviken. November 7th, 1917. (120,734.)

18,622. Electric heating elements for radiators, ovens, and other heating and cooking apparatus and appliances. J. H. Coupe and E. J. Doyle. November 13th, 1918. (134,930.)